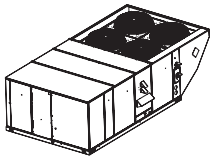
INSTALLATION MANUAL

R-410A
ZJ SERIES

15 - 25 Ton

60 Hertz



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General

YORK® Model ZJ units are either single package air conditions equipped with optional factory installed electric heaters, or single package gas-fired central heating furnaces with cooling unit. Both are designed for outdoor installation on a rooftop or slab.

The units are completely assembled on rigid, permanently attached base rails. All piping, refrigerant charge, and electrical wiring is factory installed and tested. The units require electric power, gas connection, duct connections, installation of combustion air inlet hood, flue gas outlet hoods and fixed outdoor air intake damper (units without economizer or motorized damper option only) at the point of installation.

The supplemental electric heaters have nickel-chrome elements and utilize single point power connection.

These gas-fired heaters have aluminized-steel or optional stainless steel, tubular heat exchangers with spark ignition with proven pilot. All gas heaters are shipped from the factory equipped for natural gas use, but can be field converted to L.P./Propane with Kit Model # 1NP0418. See Gas Heat Application Data Table.

Safety Considerations

This is a safety alert symbol. When you see this symbol on labels or in manuals, be alert to the potential for personal injury.

Understand and pay particular attention the signal words **DANGER**, **WARNING** or **CAUTION**.

DANGER indicates an **imminently** hazardous situation, which, if not avoided, **will result in death or serious injury.**

WARNING indicates a **potentially** hazardous situation, which, if not avoided, **could result in death or serious injury.**

CAUTION indicates a potentially hazardous situation, which, if not avoided **may result in minor or moderate injury.** It is also used to alert against unsafe practices and hazards involving only property damage.

⚠WARNING

Improper installation may create a condition where the operation of the product could cause personal injury or property damage. Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual for assistance or for additional information, consult a qualified contractor, installer or service agency.

⚠ CAUTION

This product must be installed in strict compliance with the installation instructions and any applicable local, state and national codes including, but not limited to building, electrical, and mechanical codes.

⚠WARNING

Before performing service or maintenance operations on unit, turn off main power switch to unit. Electrical shock could cause personal injury. Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information consult a qualified installer, service agency or the gas supplier.

⚠ CAUTION

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system. Gage sets, hoses, refrigerant containers and recovery systems must be designed to handle R-410A. If you are unsure, consult the equipment manufacturer. Failure to use R-410A compatible servicing equipment may result in property damage or injury.

⚠WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS:

a. Do not try to light any appliance.

b. Do not touch any electrical switch; do not use any phone in your building.

c. Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.

d. If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

Due to system pressure, moving parts, and electrical components, installation and servicing of air conditioning equipment can be hazardous. Only qualified, trained service personnel should install, repair, or service this equipment. Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters.

Observe all precautions in the literature, labels, and tags accompanying the equipment whenever working on air conditioning equipment. Be sure to follow all other applicable safety precautions and codes including ANSI Z223.1 or CSA-B149.1- latest edition.

Wear safety glasses and work gloves. Use quenching cloth and have a fire extinguisher available during brazing operations.

Inspection

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent should be made in writing.

⚠ CAUTION

This product must be installed in strict compliance with the enclosed installation instructions and any applicable local, state and national codes including, but not limited to, building, electrical, and mechanical codes.

The furnace and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing at pressures in excess of 1/2 PSIG.

Pressures greater than 1/2 PSIG will cause gas valve damage resulting in a hazardous condition. If it is subjected to a pressure greater than 1/2 PSIG, the gas valve must be replaced.

The furnace must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG

Reference

Additional information is available in the following reference forms:

- Technical Guide - ZJ180-300, 251934-YTG-A-0406
- General Installation - ZJ180-300, 173463-YIM-A-0406

Renewal Parts

Contact your local York® parts distribution center for authorized replacement parts.

Approvals

Design certified by CSA as follows:

1. For use as a cooling only unit, cooling unit with supplemental electric heat or a forced air furnace.
2. For outdoor installation only.
3. For installation on combustible material.
4. For use with natural gas (convertible to LP with kit).

⚠ CAUTION

This product must be installed in strict compliance with the enclosed installation instructions and any applicable local, state, and national codes including, but not limited to, building, electrical, and mechanical codes.

⚠WARNING

Improper installation may create a condition where the operation of the product could cause personal injury or property damage.

⚠ CAUTION

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system.

Nomenclature

15-25 Ton Sunline Magnum™ Model Number Nomenclature

Z	J	180	N24	A	2	A	AA	1	0	1	2	4	A

Product Category
Z = A/C, Single Pkg., R-410A

Product Identifier
J = 11.0+ EER A/C

Nominal Cooling Capacity
180 = 15 Ton
210 = 17.5 Ton
240 = 20 Ton
300 = 25 Ton

Heat Type and Nominal Heat Capacity
C00 = Cooling Only. No field installed electric heat

Gas Heat Options
N24 = 240 MBH Output Aluminized Steel
N32 = 320 MBH Output Aluminized Steel
S24 = 240 MBH Output Stainless Steel
S32 = 320 MBH Output Stainless Steel

Electric Heat Options
E18 = 18 KW
E36 = 36 KW
E54 = 54 KW
E72 = 72 KW

Airflow
A = Std. Drive
B = Std. Drive/Single Input Econo.
C = Std. Drive/Single Input Econo./Power Exhaust (Downflow Only)
D = Std. Drive/Motorized Damper
N = Hi Static Drive
P = Hi Static Drive/Single Input Econo.
Q = Hi Static Drive/Single Input Econo./Power Exhaust (Downflow Only)
R = Hi Static Drive/Motorized Damper

Voltage
2 = 208/230-3-60
4 = 460-3-60
5 = 575-3-60

Installation Options
A = No Options Installed
B = Option 1
C = Option 2
D = Options 1 & 2
E = Option 3
F = Option 4
G = Options 1 & 3
H = Options 1 & 4
J = Options 1, 2 & 3
K = Options 1, 2, & 4
L = Options 1,3 & 4
M = Options 1, 2, 3, & 4
N = Options 2 & 3
P = Options 2 & 4
Q = Options 2, 3, & 4
R = Options 3 & 4
S = Option 5
T = Options 1 & 5
U = Options 1, 3, & 5
V = Options 1, 4, & 5
W = Options 1, 3, 4, & 5
X = Options 3 & 5
Y = Options 4 & 5
Z = Options 3, 4 & 5

Options
1 = Disconnect
2 = Non-Pwr'd Conv. Outlet
3 = Smoke Detector S.A.
4 = Smoke Detector R.A.
5 = Pwr'd Conv. Outlet

Additional Options

Standard Cabinet	Hinged Filter Door & Toolless Access Cabinet
AA = None AB = Phase Monitor AC = Coil Guard AD = Dirty Filter Switch AE = Phase Monitor & Coil Guard AF = Phase Monitor & Dirty Filter Switch AG = Coil Guard & Dirty Filter Switch AH = Phase Monitor, Coil Guard & Dirty Filter Switch RC = Coil Guard & American Flag TA = Technicoat Condenser Coil TJ = Technicoat Evaporator Coil TS = Technicoat Evaporator & Condenser Coils	BA = Hinged Filter Door & Toolless Access Panels BB = Phase Monitor, Hinged Filter Door & Toolless Access Panels BC = Coil Guard, Hinged Filter Door & Toolless Access Panels BD = Dirty Filter Switch, Hinged Filter Door & Toolless Access Panels BE = Phase Monitor & Coil Guard, Hinged Filter Door & Toolless Access Panels BF = Phase Monitor & Dirty Filter Switch, Hinged Filter Door & Toolless Access Panels BG = Coil Guard & Dirty Filter Switch, Hinged Filter Door & Toolless Access Panels BH = Phase Monitor, Coil Guard & Dirty Filter Switch, Hinged Filter Door & Toolless Access Panels

ZZ = If desired option combination is not listed above, ZZ will be assigned and configuration options will be located in digits 15-18.

Product Generation
1 = First Generation

Configuration Options (not required for all units)
These four digits will not be assigned until a quote is requested, or an order placed.
- SS Drain Pan
- CPC Controller, DFS, APS
- Johnson Controller, DFS, APS
- Honeywell Controller, DFS, APS
- Novar Controller, DFS, APS
- Simplicity IntelliComfort Controller
- Simplicity IntelliComfort Controller w/ModLinc
- 2" Pleated filters
- 4" Pleated filters
- BAS Ready Unit with Belimo Economizer
- Double Wall Construction
- Heat Reclaim Coil Options (2 or 3 Row, 1-5/8" or 2-1/8" Stub Out) (WJ and WR models only)
- Any Combination of Additional Options that Don't Have an Option Code Pre-assigned

Product Style
A = Style A

Installation

Installation Safety Information

Read these instructions before continuing this appliance installation. This is an outdoor combination heating and cooling unit. The installer must assure that these instructions are made available to the consumer and with instructions to retain them for future reference.

1. Refer to the unit rating plate for the approved type of gas for this product.
2. Install this unit only in a location and position as specified on Page 7 of these instructions.
3. Never test for gas leaks with an open flame. Use commercially available soap solution made specifically for the detection of leaks when checking all connections, as specified on Pages 5, 23 and 47 of these instructions.
4. Always install furnace to operate within the furnace's intended temperature-rise range with the duct system and within the allowable external static pressure range, as specified on the unit name/rating plate, specified on Page 22 of these instructions.
5. This equipment is not to be used for temporary heating of buildings or structures under construction.

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

Limitations

These units must be installed in accordance with the following:

In U.S.A.:

1. National Electrical Code, ANSI/NFPA No. 70 - Latest Edition
2. National Fuel Gas Code, ANSI Z223.1 - Latest Edition
3. Gas-Fired Central Furnace Standard, ANSI Z21.47a. - Latest Edition
4. Local building codes, and
5. Local gas utility requirements

In Canada:

1. Canadian Electrical Code, CSA C22.1
2. Installation Codes, CSA - B149.1.
3. Local plumbing and waste water codes, and
4. Other applicable local codes.

Refer to unit application data found in this document.

After installation, gas fired units must be adjusted to obtain a temperature rise within the range specified on the unit rating plate.

If components are to be added to a unit to meet local codes, they are to be installed at the dealer’s and/or customer’s expense.

Size of unit for proposed installation should be based on heat loss/heat gain calculation made according to the methods of Air Conditioning Contractors of America (ACCA).

This furnace is not to be used for temporary heating of buildings or structures under construction.

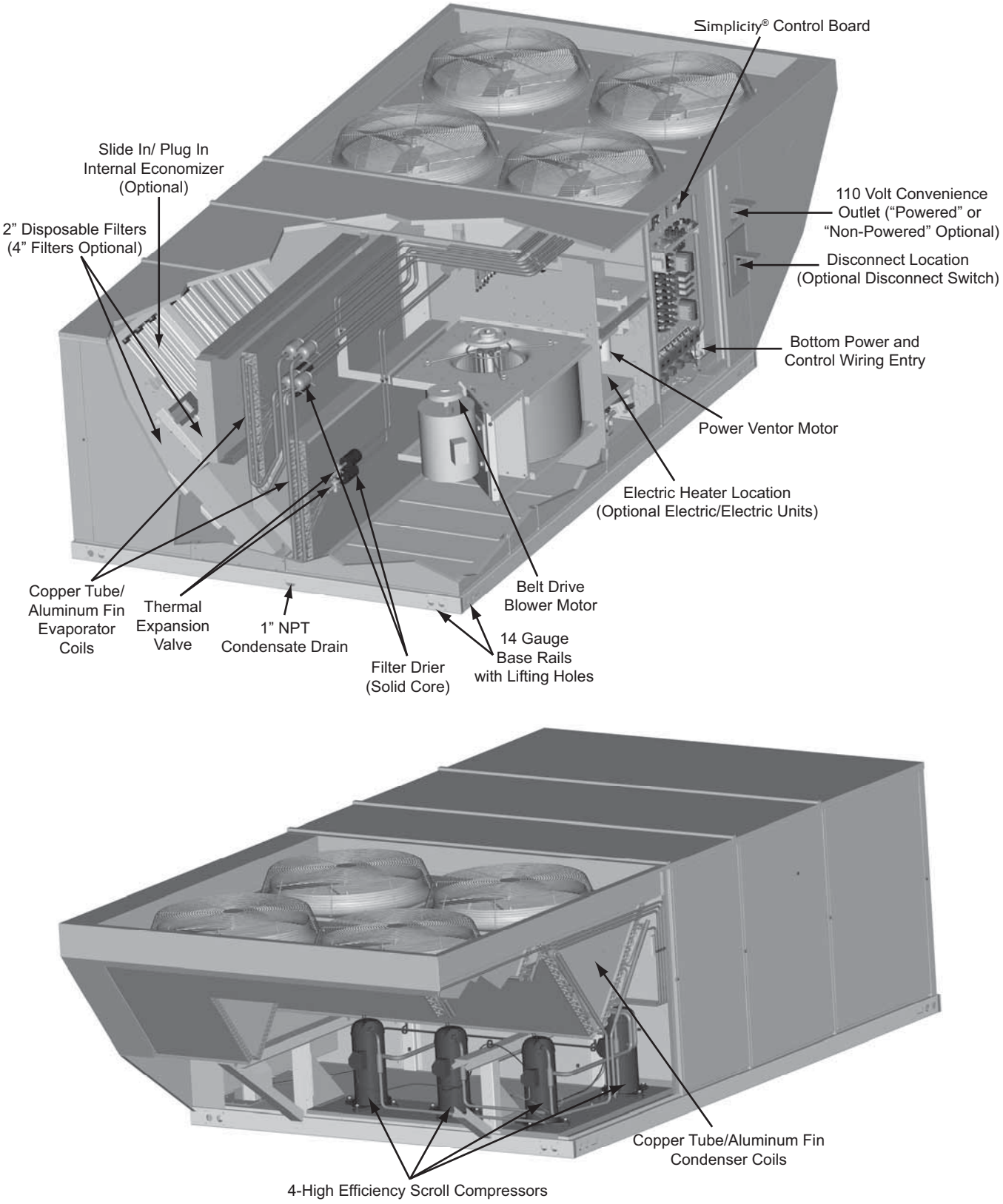


Figure 1: ZJ180-300 Component Location

Table 1: ZJ180-300 Unit Limitations

Size (Tons)	Unit Voltage	Unit Limitations		
		Applied Voltage		Outdoor DB Temp
		Min	Max	Max (°F)
180 (15)	208/230-3-60	187	252	125
	460-3-60	432	504	125
	575-3-60	540	630	125
210 (17.5)	208/230-3-60	187	252	125
	460-3-60	432	504	125
	575-3-60	540	630	125
240 (20)	208/230-3-60	187	252	125
	460-3-60	432	504	125
	575-3-60	540	630	125
300 (25)	208/230-3-60	187	252	125
	460-3-60	432	504	125
	575-3-60	540	630	125

Location

Use the following guidelines to select a suitable location for these units:

1. Unit is designed for *outdoor installation only*.
2. Condenser coils must have an unlimited supply of air. Where a choice of location is possible, position the unit on either north or east side of building.
3. Suitable for mounting on roof curb.
4. For ground level installation, use a level concrete slab with a minimum thickness of 4 inches. The length and width should be at least 6 inches greater than the unit base rails. Do not tie slab to the building foundation.
5. Roof structures must be able to support the weight of the unit and its options/accessories. Unit must be installed on a solid, level roof curb or appropriate angle iron frame.
6. Maintain level tolerance to 1/2” across the entire width and length of unit.

⚠WARNING

Excessive exposure of this furnace to contaminated combustion air may result in equipment damage or personal injury. Typical contaminates include: permanent wave solution, chlorinated waxes and cleaners, chlorine based swimming pool chemicals, water softening chemicals, carbon tetrachloride, Halogen type refrigerants, cleaning solvents (e.g. perchloroethylene), printing inks, paint removers, varnishes, hydrochloric acid, cements and glues, antistatic fabric softeners for clothes dryers, masonry acid washing materials.

Clearances

All units require particular clearances for proper operation and service. Installer must make provisions for adequate combustion and ventilation air in accordance with section 5.3 of Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 – Latest Edition (in U.S.A.), or Sections 7.2, 7.3, or 7.4 of Gas Installation Codes, CSA-B149.1 (in Canada) - Latest Edition, and/or applicable provisions of the local building codes. Refer to Table 5 for clearances required for combustible construction, servicing, and proper unit operation.

⚠WARNING

Do not permit overhanging structures or shrubs to obstruct condenser air discharge outlet, combustion air inlet or vent outlets.

Rigging And Handling

Exercise care when moving the unit. Do not remove any packaging until the unit is near the place of installation. Rig the unit by attaching chain or cable slings to the lifting holes provided in the base rails. Spreader bars, whose length exceeds the largest dimension across the unit, **MUST** be used across the top of the unit.

⚠ CAUTION

If a unit is to be installed on a roof curb other than a York® roof curb, gasketing must be applied to all surfaces that come in contact with the unit underside.

⚠ CAUTION

Before lifting, make sure the unit weight is distributed equally on the rigging cables so it will lift evenly.

Units may be moved or lifted with a forklift. Slotted openings in the base rails are provided for this purpose.

LENGTH OF FORKS MUST BE A MINIMUM OF 90 INCHES.

⚠ CAUTION

All panels must be secured in place when the unit is lifted.

The condenser coils should be protected from rigging cable damage with plywood or other suitable material.

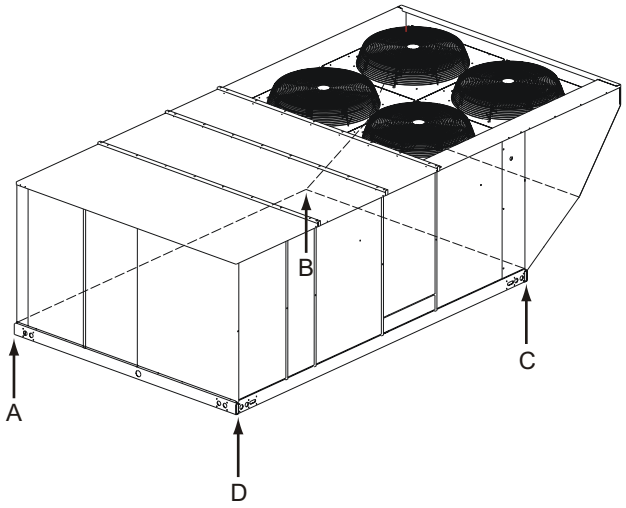


Figure 2: Unit 4 Point Load Weight

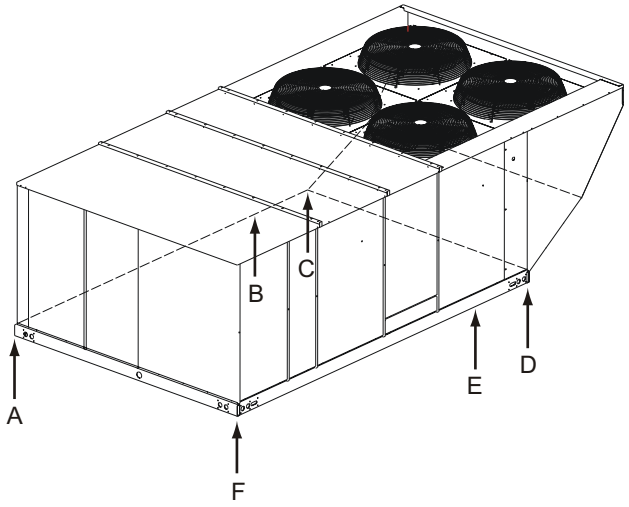


Figure 3: Unit 6 Point Load Weight

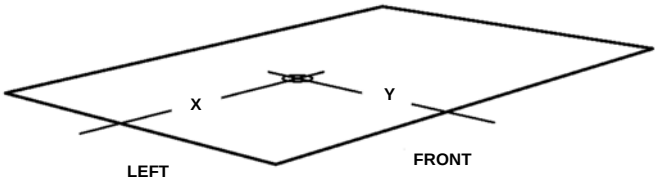


Figure 4: Center of Gravity

Table 2: Weights and Dimensions

Size	Weight (lbs.)		Center of Gravity		4 Point Load Location (lbs.)				6 Point Load Location (lbs.)					
(Tons)	Shipping	Operating	X	Y	A	B	C	D	A	B	C	D	E	F
180 (15)	2614	2609	85.25	44	467	781	852	510	287	392	568	620	428	313
210 (17.5)	2670	2665	85.25	44	477	797	870	520	293	401	580	633	437	320
240 (20)	2702	2697	85.05	44	485	805	878	529	298	406	585	638	443	326
300 (25)	2788	2783	85.25	44	498	833	908	544	306	419	606	661	457	334

Table 3: ZJ180-300 Unit Accessory Weights

Unit Accessory	Weight (lbs.)	
	Shipping	Operating
Economizer	165	160
Power Exhaust	250	245
Electric Heat[1]	40	40
Gas Heat[2]	240	240
Double Wall	260	260
Motorized Damper	150	150
Barometric Damper	50	45
Econ./Motorized Damper Rain Hood	60	55
Econ./Power Exhaust Rain Hood	95	90
Wood Skid	220	220
Roof Curb	190	185

1. Weight given is for the maximum heater size available (54KW).
2. Weight given is for the maximum number of tube heat exchangers available (8 tube).

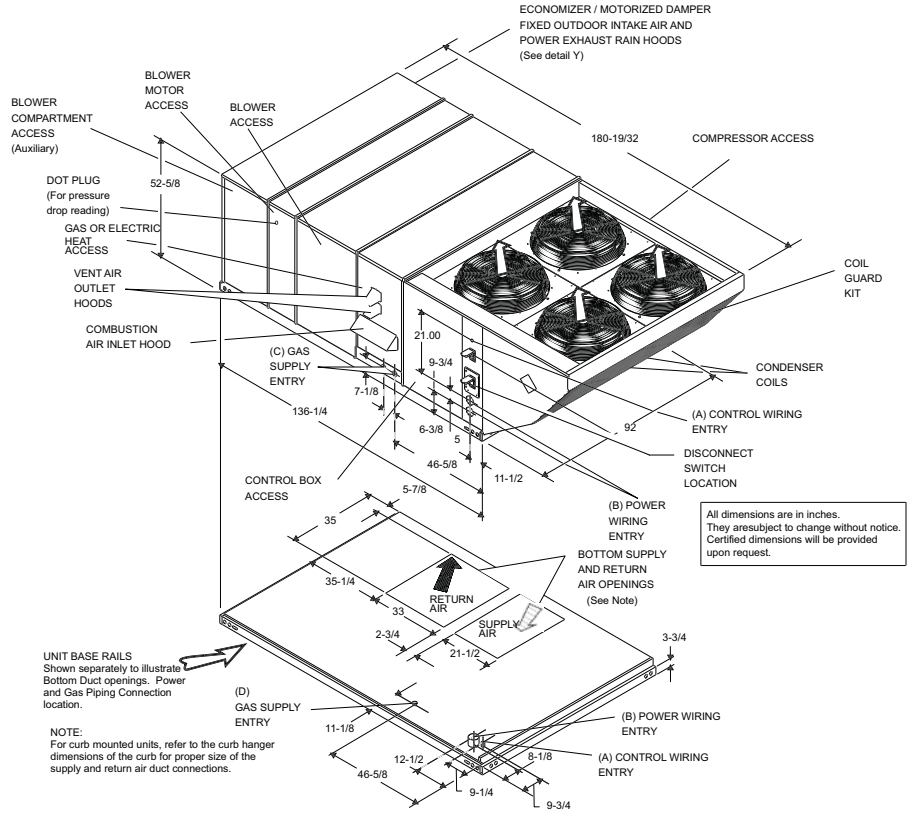


Figure 5: ZJ180-300 Unit Dimensions Front View

Table 4: Utilities Entry

Hole	Opening Size Diameter	Used For	
A	1-1/8" KO	Control Wiring	Front
	3/4" NPS (Fem.)		Bottom
B	3-5/8" KO	Power Wiring	Front
	3" NPS (Fem.)		Bottom
C	2-3/8" KO	Gas Piping (Front)[1]	
D	1-11/16" Hole	Gas Piping (Bottom)[1,2]	

1. One-inch Gas Piping NPT Required.
2. Opening in the bottom to the unit can be located by the slice in the insulation.

Note: All entry holes should be sealed to prevent rain water entry into building.

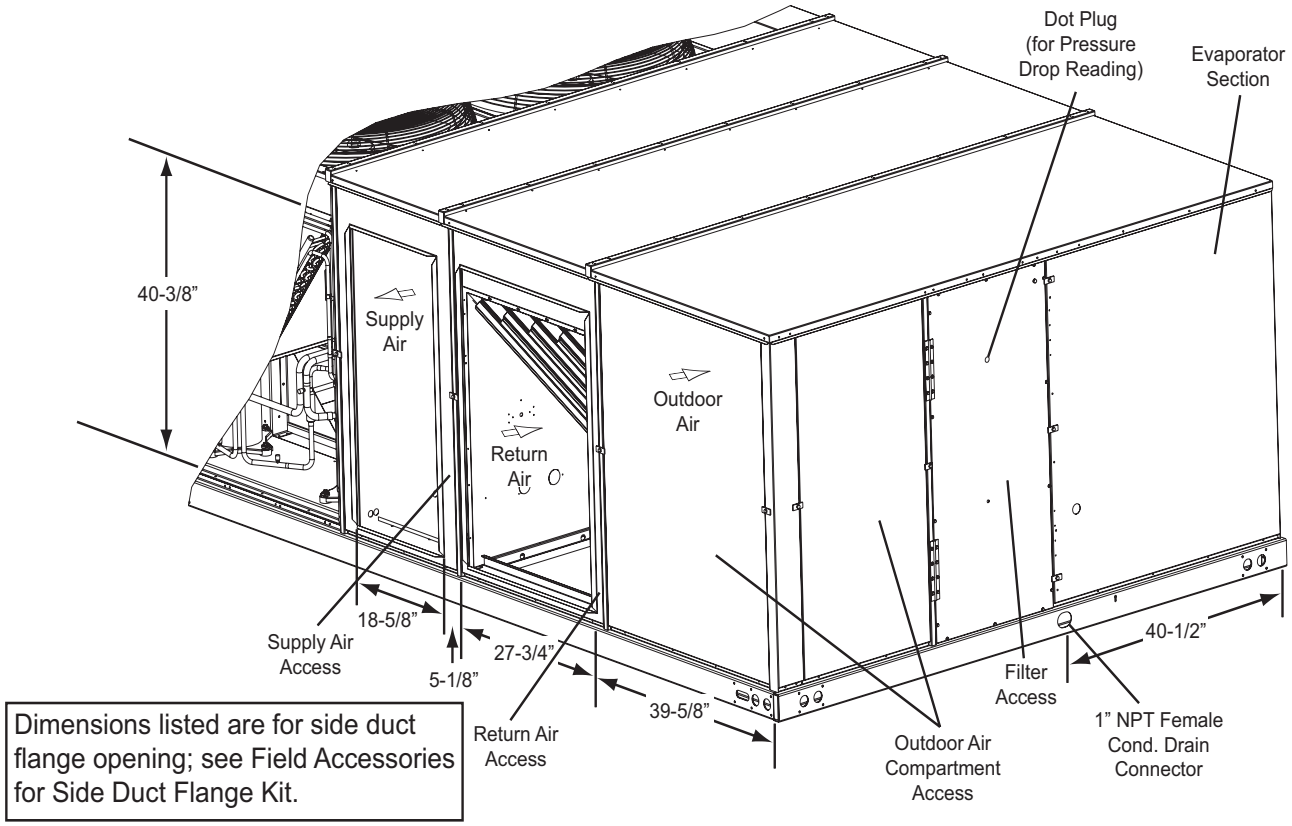


Figure 6: ZJ180-300 Unit Dimensions Rear View

NOTE: Units are shipped with the bottom duct openings covered. An accessory flange kit is available for connecting side ducts.

For <u>bottom</u> duct applications:

1. Remove the side panels from the supply and return air compartments to gain access to the bottom supply and return air duct covers.
2. Remove and discard the bottom duct covers. Duct openings are closed with sheet metal covers except when the unit includes a power exhaust option. The covering consists of a heavy black paper composition.
3. Replace the side supply and return air compartment panels.

For <u>side</u> duct applications:

1. Replace the side panels on the supply and return air compartments with the accessory flange kit panels.
2. Connect ductwork to the flanges on those panels.

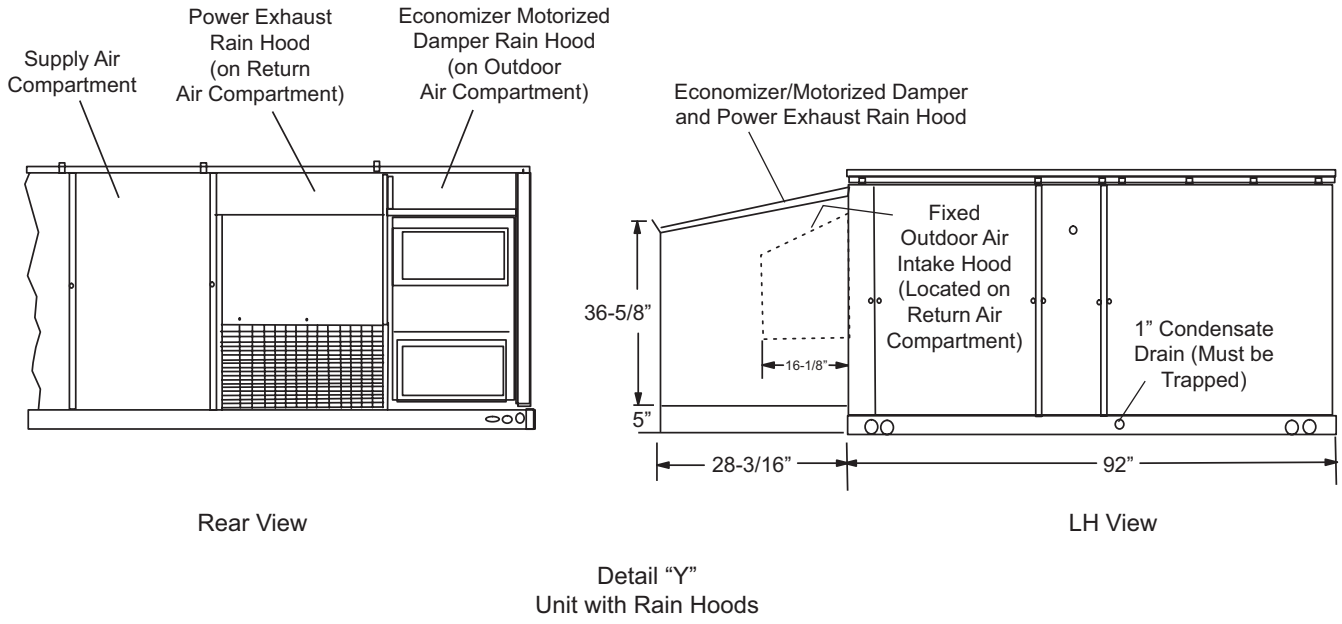


Figure 7: ZJ180-300 Unit Dimensions Rain Hood

Table 5: ZJ180-300 Unit Clearances

Direction	Distance (in.)	Direction	Distance (in.)
Top[1]	72 With 36 Maximum Horizontal Overhang (For Condenser Air Discharge)	Right	36
Front	36	Bottom[2]	0
Rear	24 (W/O Economizer)	Left	24 (W/O Economizer)
	49 (W/Economizer)		36 (W/Economizer)[3]

1. Units must be installed outdoors. Over hanging structure or shrubs should not obscure condenser air discharge outlet.
2. Units may be installed on combustable floors made from wood or class A, B or C roof covering materials.
3. If economizer is factory installed, the unassembled rain hood must be removed from its ride along position in front of the evaporator coil, or in the outdoor air compartment, prior to final installation.

Note: ELEC/ELEC Models: Units and ductwork are approved for zero clearance to combustible material when equipped with electric heaters.

GAS/ELEC Models: A 1" clearance must be provided between any combustible material and the supply air ductwork for a distance of 3 feet from the unit.

The products of combustion must not be allowed to accumulate within a confined space and recirculate.

Locate unit so that the vent air outlet hood is at least:

- Three (3) feet above any force air inlet located within 10 horizontal feet (excluding those integral to the unit).
- Four (4) feet below, four horizontal feet from, or one foot above any door or gravity air inlet into the building.
- Four (4) feet from electric and gas meters, regulators and relief equipment.

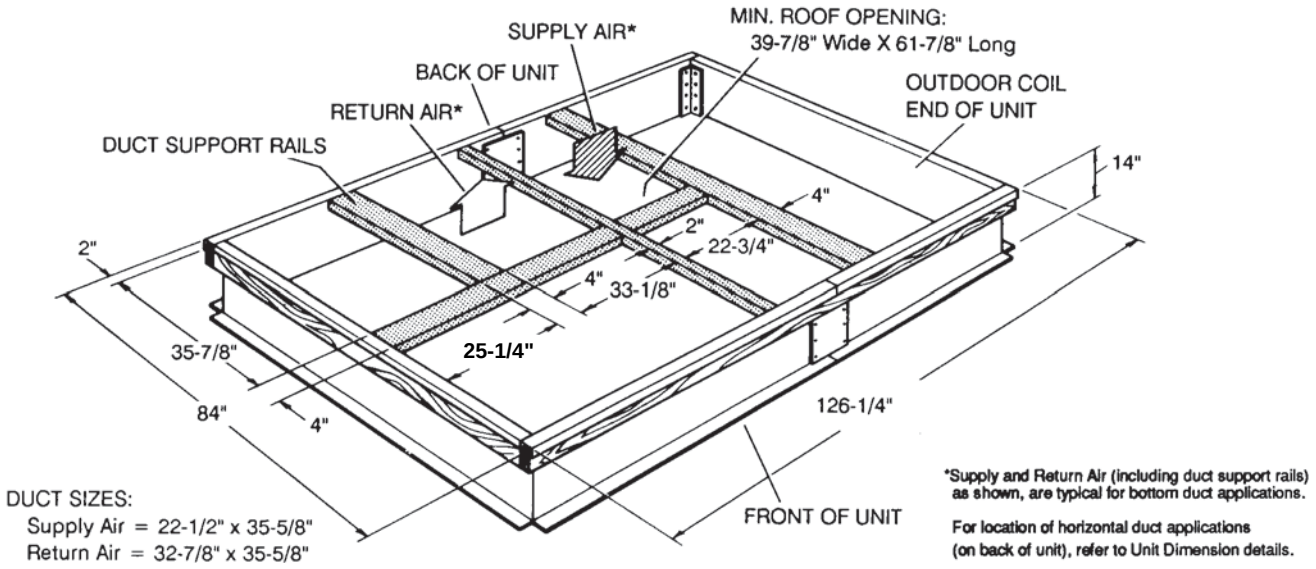


Figure 8: ZJ180-300 Roof Curb

Ductwork

Ductwork should be designed and sized according to the methods in Manual D of the Air Conditioning Contractors of America (ACCA) or as recommended by any other recognized authority such as ASHRAE or SMACNA.

A closed return duct system should be used. This will not preclude use of economizers or outdoor fresh air intake. The supply and return air duct connections at the unit should be made with flexible joints to minimize noise.

The supply and return air duct systems should be designed for the CFM and static pressure requirements of the job. They should NOT be sized to match the dimensions of the duct connections on the unit.

Refer to Figure 5 for bottom air duct openings. Refer to Figure 6 for side air duct openings.

NOTE: It is recommended that, in Canada, the outlet duct be provided with a removable access panel. It is recommended that this opening be accessible when the unit is installed in service, and of a size such that smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heat exchanger. The cover should be attached in a manner adequate to prevent leakage.

Fixed Outdoor Air Intake Damper

This damper is shipped inside the return air compartment. It is completely assembled and ready for installation. A damper baffle inside of the hood is adjustable to provide variable amounts of outdoor air intake on units that are not provided with an economizer or a motorized damper option. Refer to the Fixed Outdoor Damper Figure 9.

Gasketing and mounting screws are provided in a parts bag attached to the hood assembly. Apply gasketing to the three flange surfaces on the hood prior to installing the hood. Extend gasketing 1/4 inch beyond the top and bottom of the two side flanges to insure adequate sealing.

Adjusting the damper to the desired air flow may be done before mounting the hood into position or after installation by removing the front hood panel or the screen on the bottom of the hood. Damper baffle in position 1 will allow approximately 10% outdoor air flow, position 2 approximately 15% and, to allow approximately 25%, remove the damper baffle.

On units with bottom return air application install the damper assembly over the opening in the side return air access panel. Remove and discard the opening cover and the covering over the hood mounting holes (used for shipping) before installing. Secure with the screws provided.

On units with side return air applications, install the damper assembly on the return air ductwork as close to the unit as possible. Cut an opening 16 inches high by 18 inches wide in the ductwork to accommodate the damper. Using the holes in the hood flanges as a template, drill 9/64 inch diameter (#26 drill) holes into the ductwork and secure with the screws provided.

⚠ CAUTION

If outdoor air intake will not be required on units with bottom return air applications, the damper assembly should still be mounted on the side return air access panel, per the instructions above, to insure moisture is not drawn into the unit during operation. The covering over the mounting holes only need be removed. Do not remove the opening cover.

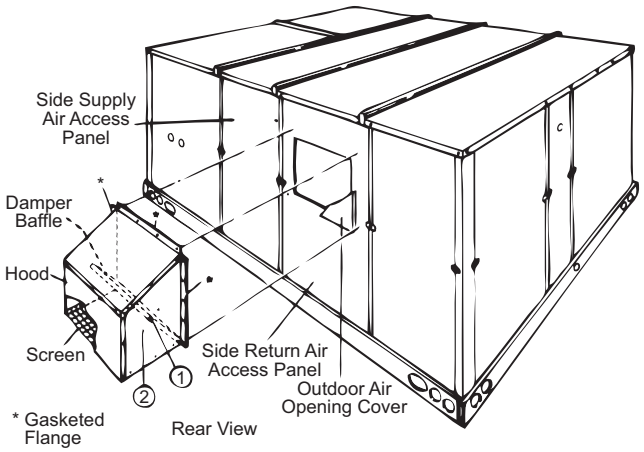


Figure 9: Fixed Outdoor Air Damper

Condensate Drain

Plumbing must conform to local codes. Use a sealing compound on male pipe threads. Install a condensate drain line from the one-inch NPT female connection on the unit to an open drain.

NOTE: The condensate drain operates in a negative pressure in the cabinet. The condensate drain line MUST be trapped to provide proper drainage. See Figure 10.

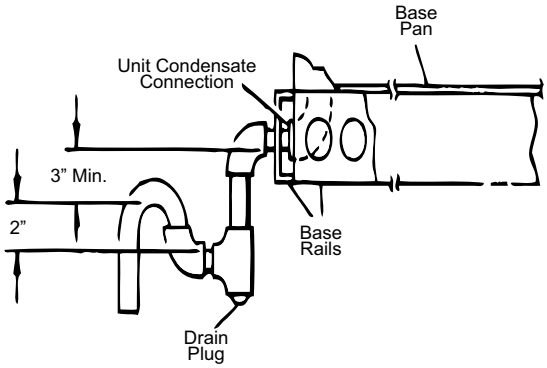


Figure 10: Condensate Drain

Compressors

The scroll compressor used in this product is specifically designed to operate with R-410A Refrigerant and cannot be interchanged.

⚠ CAUTION

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system.

The compressor also uses a polyolester (POE oil), Mobil 3MA POE. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oil can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. Take all necessary precautions to avoid exposure of the oil to the atmosphere.

⚠ CAUTION

Do not leave the system open to the atmosphere. Unit damage could occur due to moisture being absorbed by the **POE oil** in the system. This type of oil is highly susceptible to moisture absorption

POE (polyolester) compressor lubricants are known to cause long term damage to some synthetic roofing materials.

⚠ CAUTION

Exposure, even if immediately cleaned up, may cause embrittlement (leading to cracking) to occur in one year or more. When performing any service that may risk exposure of compressor oil to the roof, take precautions to protect roofing.

Procedures which risk oil leakage include, but are not limited to, compressor replacement, repairing refrigerant leaks, replacing refrigerant components such as filter drier, pressure switch, metering device or coil.

Units are shipped with compressor mountings which are factory-adjusted and ready for operation.

⚠ CAUTION

Do not loosen compressor mounting bolts.

Filters

Two-inch filters are supplied with each unit, but units can be converted easily to four-inch filters. Filters must always be installed ahead of the evaporator coil and must be kept clean or replaced with same size and type. Dirty filters will reduce the capacity of the unit and will result in frosted coils or safety shutdown. Minimum filter area and required sizes are shown in Physical Data Table 8.

⚠ CAUTION

Make sure that panel latches are properly positioned on the unit to maintain an airtight seal.

Power And Control Wiring

Field wiring to the unit, fuses, and disconnects must conform to provisions of National Electrical Code (NEC), ANSI/NFPA No. 70 – Latest Edition (in U.S.A.), current Canadian Electrical Code C221, and/or local ordinances. The unit must be electrically grounded in accordance with NEC and CEC as specified above and/or local codes.

Voltage tolerances which must be maintained at the compressor terminals during starting and running conditions are indicated on the unit Rating Plate and Table 1.

The internal wiring harnesses furnished with this unit are an integral part of the design certified unit. Field alteration to comply with electrical codes should not be required. If any of the wire supplied with the unit must be replaced, replacement wire must be of the type shown on the wiring diagram and the same minimum gauge as the replaced wire.

A disconnect must be utilized for these units. Factory installed disconnects are available. If installing a disconnect (field supplied or York International® supplied accessory), refer to Figure 1 for the recommended mounting location.

⚠ CAUTION

Avoid damage to internal components if drilling holes for disconnect mounting.

NOTE: Since not all local codes allow the mounting of a disconnect on the unit, please confirm compliance with local code before mounting a disconnect on the unit.

Electrical line must be sized properly to carry the load. USE COPPER CONDUCTORS ONLY. Each unit must be wired with a separate branch circuit fed directly from the meter panel and properly fused.

Refer to Figures 11 and 12 for typical field wiring and to the appropriate unit wiring diagram mounted inside control doors for control circuit and power wiring information.

⚠ CAUTION

When connecting electrical power and control wiring to the unit, water-proof connectors must be used so that water or moisture cannot be drawn into the unit during normal operation. The above water-proofing conditions will also apply when installing a field supplied disconnect switch.

Power Wiring Detail

Units are factory wired for the voltage shown on the unit nameplate. Refer to Electrical Data Table 7 to size power wiring, fuses, and disconnect switch.

Power wiring is brought into the unit through the side of the unit or the basepan inside the curb.

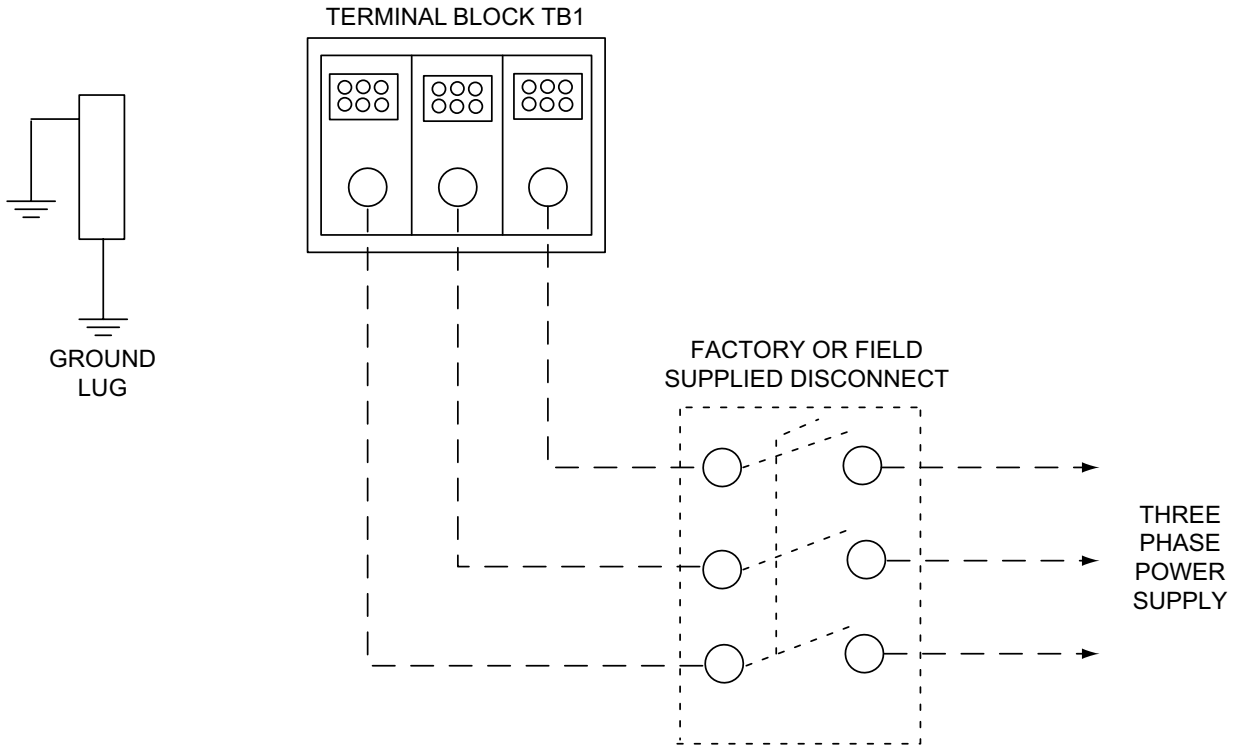


Figure 11: Field Wiring Disconnect - Cooling Unit With/Without Electric Heat

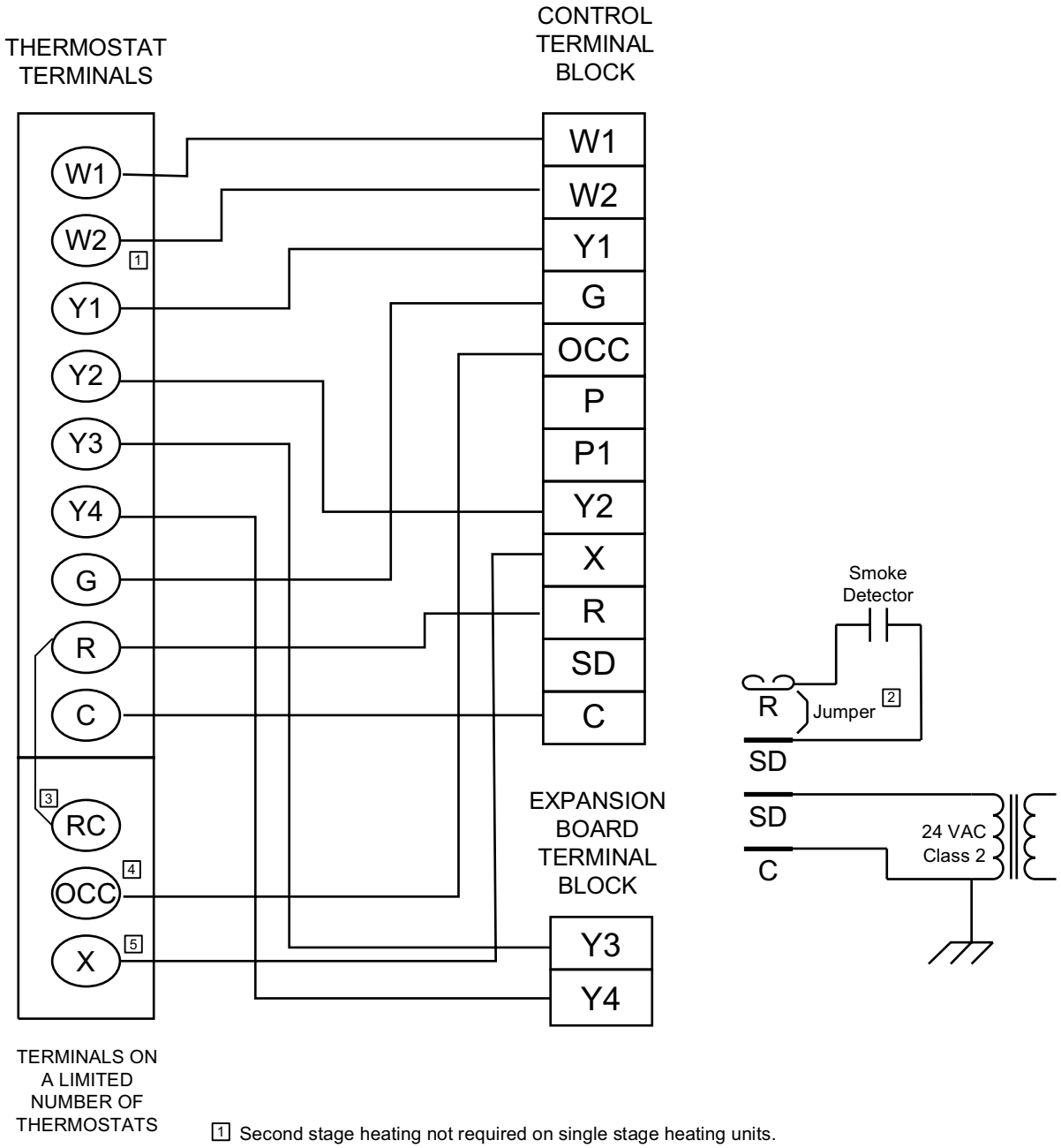
Thermostat Wiring

The thermostat should be located on an inside wall approximately 56 inch above the floor where it will not be subject to drafts, sun exposure or heat from electrical fixtures or appliances. Follow the manufacturer's instructions enclosed with thermostat for general installation procedure. Seven (7) color-coded, insulated wires should be used to connect the thermostat to the unit. Refer to Table 6 for control wire sizing and maximum length.

Table 6: Control Wire Sizes

Wire Size	Maximum Length[1]
18 AWG	150 Feet

1. From the unit to the thermostat and back to the unit.



1 Second stage heating not required on single stage heating units.

2 Jumper is required if there is no Smoke Detector circuit.

3 Jumper is required for any combination of R, RC, or RH.

4 OCC is an output from the thermostat to indicate the Occupied condition.

5 X is an input to the thermostat to display Error Status conditions.

Figure 12: Field Wiring 24 Volt Thermostat

Table 7: Electrical Data

ZJ180-300 - Without Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Motor	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
180 (15)	208-3-60	14.7	115	23.0	2.1	15.4	0.0	None	-	-	-	86.5	100
								E18	13.5	1	37.5	86.5	100
								E36	27	2	74.9	112.9	125
								E54	40.6	2	112.7	160.1	175
								E72	54.1	2	150.2	169.4	200
	230-3-60	14.7	115	23.0	2.1	14.4	0.0	None	-	-	-	85.3	90
								E18	18.0	1	43.3	85.3	90
								E36	36.0	2	86.6	126.3	150
								E54	54.0	2	129.9	147.9	175
								E72	72.0	2	173.2	191.2	225
	460-3-60	7.7	50	12.0	1.1	7.2	0.0	None	-	-	-	44.3	50
								E18	18.0	1	21.7	44.3	50
								E36	36.0	2	43.3	63.1	70
								E54	54.0	2	65.0	74.0	90
								E72	72.0	2	86.6	95.6	110
	575-3-60	6.4	40	10.0	0.9	5.9	0.0	None	-	-	-	36.7	40
								E18	18.0	1	17.3	36.7	40
								E36	36.0	2	34.6	50.7	60
								E54	54.0	2	52.0	59.3	70
								E72	72.0	2	69.3	76.7	90
210 (17.5)	208-3-60	16.7	120	26.0	2.1	20.0	0.0	None	-	-	-	100.2	110
								E18	13.5	1	37.5	100.2	110
								E36	27	2	74.9	118.7	125
								E54	40.6	2	112.7	165.9	175
								E72	54.1	2	150.2	175.2	200
	230-3-60	16.7	120	26.0	2.1	20.0	0.0	None	-	-	-	100.2	110
								E18	18.0	1	43.3	100.2	110
								E36	36.0	2	86.6	133.3	150
								E54	54.0	2	129.9	154.9	175
								E72	72.0	2	173.2	198.2	225
	460-3-60	8.7	60	13.5	1.1	10.0	0.0	None	-	-	-	51.7	60
								E18	18.0	1	21.7	51.7	60
								E36	36.0	2	43.3	66.6	70
								E54	54.0	2	65.0	77.5	90
								E72	72.0	2	86.6	99.1	110
	575-3-60	6.7	42	10.5	0.9	8.2	0.0	None	-	-	-	40.7	45
								E18	18.0	1	17.3	40.7	45
								E36	36.0	2	34.6	53.6	60
								E54	54.0	2	52.0	62.2	70
								E72	72.0	2	69.3	79.5	90
240 (20)	208-3-60	17.9	120	28.0	3.7	20.0	0.0	None	-	-	-	111.4	125
								E18	13.5	1	37.5	111.4	125
								E36	27	2	74.9	118.7	125
								E54	40.6	2	112.7	165.9	175
								E72	54.1	2	150.2	175.2	200
	230-3-60	17.9	120	28.0	3.7	20.0	0.0	None	-	-	-	111.4	125
								E18	18.0	1	43.3	111.4	125
								E36	36.0	2	86.6	133.3	150
								E54	54.0	2	129.9	154.9	175
								E72	72.0	2	173.2	198.2	225
	460-3-60	9.6	70	15.0	1.9	10.0	0.0	None	-	-	-	58.5	60
								E18	18.0	1	21.7	58.5	60
								E36	36.0	2	43.3	66.6	70
								E54	54.0	2	65.0	77.5	90
								E72	72.0	2	86.6	99.1	110
	575-3-60	7.4	53	11.5	1.5	8.2	0.0	None	-	-	-	45.9	50
								E18	18.0	1	17.3	45.9	50
								E36	36.0	2	34.6	53.6	60
								E54	54.0	2	52.0	62.2	70
								E72	72.0	2	69.3	79.5	90

ZJ180-300 - Without Powered Convenience Outlet (Continued)

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Motor	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
300 (25)	208-3-60	23.0	160	31.5	3.7	38.6	0.0	None	-	-	-	155.1	175
								E18	13.5	1	37.5	155.1	175
								E36	27	2	74.9	155.1	175
								E54	40.6	2	112.7	189.1	200
								E72	54.1	2	150.2	198.4	225
	230-3-60	23.0	160	31.5	3.7	38.6	0.0	None	-	-	-	155.1	175
								E18	18.0	1	43.3	155.1	175
								E36	36.0	2	86.6	156.5	175
								E54	54.0	2	129.9	178.2	200
								E72	72.0	2	173.2	221.5	250
	460-3-60	12.2	87	17.1	1.9	19.3	0.0	None	-	-	-	80.5	90
								E18	18.0	1	21.7	80.5	90
								E36	36.0	2	43.3	80.5	90
								E54	54.0	2	65.0	89.1	100
								E72	72.0	2	86.6	110.7	125
	575-3-60	8.7	62	13.5	1.5	15.4	0.0	None	-	-	-	60.1	70
								E18	18.0	1	17.3	60.1	70
								E36	36.0	2	34.6	62.6	70
								E54	54.0	2	52.0	71.2	80
								E72	72.0	2	69.3	88.5	100

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

ZJ180-300 - With Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
180 (15)	208-3-60	14.7	115	23.0	2.1	15.4	10.0	None	-	-	-	96.5	110
								E18	13.5	1	37.5	96.5	110
								E36	27	2	74.9	125.4	150
								E54	40.6	2	112.7	172.6	175
								E72	54.1	2	150.2	181.9	200
	230-3-60	14.7	115	23.0	2.1	14.4	10.0	None	-	-	-	95.3	100
								E18	18.0	1	43.3	95.3	100
								E36	36.0	2	86.6	138.8	150
								E54	54.0	2	129.9	160.4	175
								E72	72.0	2	173.2	203.7	225
	460-3-60	7.7	50	12.0	1.1	7.2	5.0	None	-	-	-	49.3	50
								E18	18.0	1	21.7	49.3	50
								E36	36.0	2	43.3	69.4	70
								E54	54.0	2	65.0	80.2	90
								E72	72.0	2	86.6	101.9	110
	575-3-60	6.4	40	10.0	0.9	5.9	4.0	None	-	-	-	40.7	45
								E18	18.0	1	17.3	40.7	45
								E36	36.0	2	34.6	55.7	60
								E54	54.0	2	52.0	64.3	70
								E72	72.0	2	69.3	81.7	90
210 (17.5)	208-3-60	16.7	120	26.0	2.1	20.0	10.0	None	-	-	-	110.2	125
								E18	13.5	1	37.5	110.2	125
								E36	27	2	74.9	131.2	150
								E54	40.6	2	112.7	178.4	200
								E72	54.1	2	150.2	187.7	200
	230-3-60	16.7	120	26.0	2.1	20.0	10.0	None	-	-	-	110.2	125
								E18	18.0	1	43.3	110.2	125
								E36	36.0	2	86.6	145.8	150
								E54	54.0	2	129.9	167.4	175
								E72	72.0	2	173.2	210.7	225
	460-3-60	8.7	60	13.5	1.1	10.0	5.0	None	-	-	-	56.7	60
								E18	18.0	1	21.7	56.7	60
								E36	36.0	2	43.3	72.9	80
								E54	54.0	2	65.0	83.7	90
								E72	72.0	2	86.6	105.4	110
	575-3-60	6.7	42	10.5	0.9	8.2	4.0	None	-	-	-	44.7	50
								E18	18.0	1	17.3	44.7	50
								E36	36.0	2	34.6	58.6	60
								E54	54.0	2	52.0	67.2	70
								E72	72.0	2	69.3	84.5	90
240 (20)	208-3-60	17.9	120	28.0	3.7	20.0	10.0	None	-	-	-	121.4	125
								E18	13.5	1	37.5	121.4	125
								E36	27	2	74.9	131.2	150
								E54	40.6	2	112.7	178.4	200
								E72	54.1	2	150.2	187.7	200
	230-3-60	17.9	120	28.0	3.7	20.0	10.0	None	-	-	-	121.4	125
								E18	18.0	1	43.3	121.4	125
								E36	36.0	2	86.6	145.8	150
								E54	54.0	2	129.9	167.4	175
								E72	72.0	2	173.2	210.7	225
	460-3-60	9.6	70	15.0	1.9	10.0	5.0	None	-	-	-	63.5	70
								E18	18.0	1	21.7	63.5	70
								E36	36.0	2	43.3	72.9	80
								E54	54.0	2	65.0	83.7	90
								E72	72.0	2	86.6	105.4	110
	575-3-60	7.4	53	11.5	1.5	8.2	4.0	None	-	-	-	49.9	50
								E18	18.0	1	17.3	49.9	50
								E36	36.0	2	34.6	58.6	60
								E54	54.0	2	52.0	67.2	70
								E72	72.0	2	69.3	84.5	90

ZJ180-300 - With Powered Convenience Outlet (Continued)

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
300 (25)	208-3-60	23.0	160	31.5	3.7	38.6	10.0	None	-	-	-	165.1	200
								E18	13.5	1	37.5	165.1	200
								E36	27	2	74.9	165.1	200
								E54	40.6	2	112.7	201.6	225
								E72	54.1	2	150.2	210.9	225
	230-3-60	23.0	160	31.5	3.7	38.6	10.0	None	-	-	-	165.1	200
								E18	18.0	1	43.3	165.1	200
								E36	36.0	2	86.6	169.0	200
								E54	54.0	2	129.9	190.7	225
								E72	72.0	2	173.2	234.0	250
	460-3-60	12.2	87	17.1	1.9	19.3	5.0	None	-	-	-	85.5	100
								E18	18.0	1	21.7	85.5	100
								E36	36.0	2	43.3	85.5	100
								E54	54.0	2	65.0	95.3	110
								E72	72.0	2	86.6	117.0	125
	575-3-60	8.7	62	13.5	1.5	15.4	4.0	None	-	-	-	64.1	70
								E18	18.0	1	17.3	64.1	70
								E36	36.0	2	34.6	67.6	70
								E54	54.0	2	52.0	76.2	90
								E72	72.0	2	69.3	93.5	100

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

Table 8: ZJ180-300 Physical Data

Component	Models							
	ZJ180		ZJ210		ZJ240		ZJ300	
Nominal Tonnage	**15**		**17.5**		**20**		**25**	
ARI COOLING PERFORMANCE								
Gross Capacity @ ARI A point (Btu)	183500		213700		242000		312000	
ARI net capacity (Btu)	178500		206000		235000		295000	
EER	12.4		12.1		11.6		10.4	
SEER	-		-		-		-	
IPLV	13.9		13.2		12.9		10.6	
Nominal CFM	6000		7000		8000		10000	
System power (KW)	14.40		17.10		20.10		28.50	
Refrigerant type	R-410A		R-410a		R-410a		R-410a	
Refrigerant charge (lb-oz)								
System 1	12-8		12-8		12-0		12-8	
System 2	12-8		13-8		12-0		13-8	
System 3	12-8		12-8		12-0		13-0	
System 4	12-8		12-8		12-0		12-8	
ARI HEATING PERFORMANCE								
Heating model	24	32	24	32	24	32	24	32
Heat input (K Btu)	300	400	300	400	300	400	300	400
Heat output (K Btu)	240	320	240	320	240	320	240	320
AFUE %	-	-	-	-	-	-	-	-
Steady state efficiency (%)	80	80	80	80	80	80	80	80
No. burners	6	8	6	8	6	8	6	8
No. stages	2	2	2	2	2	2	2	2
Temperature Rise Range (ºF)	20-50	30-60	20-50	30-60	20-50	30-60	20-50	30-60
Gas Limit Setting (ºF)	195	195	195	195	195	195	195	195
Gas piping connection (in.)	1	1	1	1	1	1	1	1
DIMENSIONS (inches)								
Length	92		92		92		92	
Width	66-1/2		66-1/2		66-1/2		66-1/2	
Height	45-7/8		45-7/8		45-7/8		45-7/8	
OPERATING WT. (lbs.)	2609		2665		2697		2783	
COMPRESSORS								
Type	Scroll		Scroll		Scroll		Scroll	
Quantity	4		4		4		4	
Unit Capacity Steps (%)	25 / 50 / 75 / 100		25 / 50 / 75 / 100		25 / 50 / 75 / 100		25 / 50 / 75 / 100	
CONDENSER COIL DATA								
Face area (Sq. Ft.)	63.8		63.8		63.8		63.8	
Rows	2		2		2		2	
Fins per inch	20		20		20		20	
Tube diameter (in.)	3/8		3/8		3/8		3/8	
Circuitry Type	Split-face		Split-face		Split-face		Split-face	
EVAPORATOR COIL DATA								
Face area (Sq. Ft.)	25		25		25		25	
Rows	4		4		4		4	
Fins per inch	13.5		13.5		13.5		13.5	
Tube diameter	0.375		0.375		0.375		0.375	
Circuitry Type	Split-face		Split-face		Split-face		Split-face	
Refrigerant control	TXV		TXV		TXV		TXV	
CONDENSER FAN DATA								
Quantity	4		4		4		4	
Fan diameter (Inch)	24		24		30		30	

Table 8: ZJ180-300 Physical Data (Continued)

Component	Models							
	ZJ180		ZJ210		ZJ240		ZJ300	
Nominal Tonnage	**15**		**17.5**		**20**		**25**	
Type	Prop		Prop		Prop		Prop	
Drive type	Direct		Direct		Direct		Direct	
No. speeds	1		1		1		1	
Number of motors	2		2		2		2	
Motor HP each	1/3		1/3		1/3		1/3	
RPM	850		850		870		870	
Nominal total CFM	4000		4000		5000		5000	
BELT DRIVE EVAP FAN DATA								
Quantity	1		1		1		1	
Fan Size (Inch)	15 X 15		18 X 15		18 X 15		18 X 15	
Type	Centrifugal		Centrifugal		Centrifugal		Centrifugal	
Motor Sheave	1VP56	1VP56	1VP68	1VP68	1VP68	1VP68	1VP75X	1VP75X
Blower Sheave	BK90	BK80	BK120	BK120	BK120	BK120	1B5V110	1B5V94
Belt	BX81	BX78	BX83	BX81	BX83	BX81	5VX860	5VX860
Motor HP each	5	5	7.5	7.5	7.5	7.5	15	15
RPM	1725	1725	1725	1725	1725	1725	1725	1725
Frame size	184T	184T	213T	213T	213T	213T	254T	254T
FILTERS								
Quantity - Size	12 - 12 x 24 x 2		12 - 12 x 24 x 2		12 - 12 x 24 x 2		12 - 12 x 24 x 2	

Optional Electric Heat

The factory-installed heaters are wired for single point power supply. Power supply need only be brought into the single point terminal block.

These CSA approved heaters are located within the central compartment of the unit with the heater elements extending in to the supply air chamber.

Fuses are supplied, where required, by the factory. Some kW sizes require fuses and others do not. refer to Table 9 for minimum CFM limitations and to Table 7 for electrical data.

Table 9: Electric Heat Minimum Supply Air

Size (Tons)	Voltage	Minimum Supply Air (CFM)			
		Heater kW			
		9	18	54	72
180 (15)	208/230-3-60	4500	4500	5000	5000
	460-3-60	4500	4500	5000	4500
	600-3-60	4500	4500	4500	4500
210 (17.5)	208/230-3-60	6000	6000	6000	6000
	460-3-60	6000	6000	6000	6000
	600-3-60	6000	6000	6000	6000
240 (20)	208/230-3-60	6000	6000	6000	6000
	460-3-60	6000	6000	6000	6000
	600-3-60	6000	6000	6000	6000
300 (25)	208/230-3-60	7500	7500	7500	7500
	460-3-60	7500	7500	7500	7500
	600-3-60	7500	7500	7500	7500

Optional Gas Heat

These gas-fired heaters have aluminized-steel or optional stainless steel, tubular heat exchangers with spark ignition with proven pilot.

Table 10: Gas Application Data

Unit		Input (MBH)	Output (MBH)	Temp Rise (°F)
Size	Opt.			
180	24	300	240	20-50
	32	400	320	30-60
210	24	300	240	20-50
	32	400	320	30-60
240	24	300	240	20-50
	32	400	320	30-60
300	24	300	240	20-50
	32	400	320	30-60

Gas Piping

Proper sizing of gas piping depends on the cubic feet per hour of gas flow required, specific gravity of the gas and the length of run. “National Fuel Gas Code” Z223.1 (in U.S.A.) or the current Gas Installation Codes CSA-B149.1 (in Canada) should be followed in all cases unless superseded by local codes or gas utility requirements. Refer to the Pipe Sizing Table 11. The heating value of the gas may differ with locality. The value should be checked with the local gas utility.

NOTE: There may be a local gas utility requirement specifying a minimum diameter for gas piping. All units require a one-inch pipe connection at the entrance fitting.

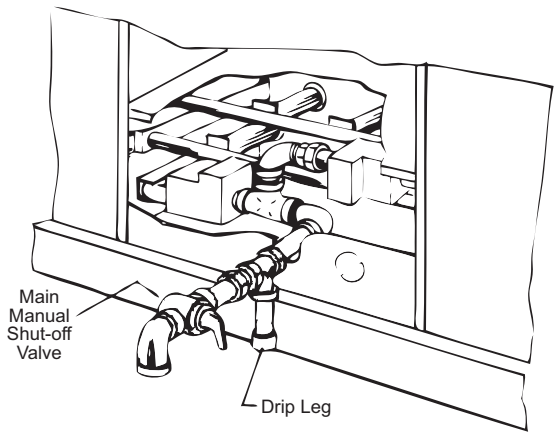


Figure 13: External Supply Connection External Shut-Off

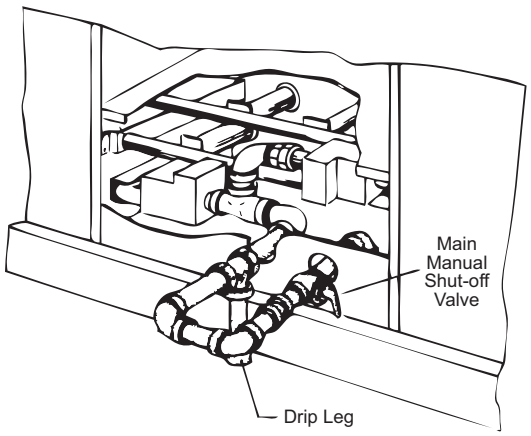


Figure 14: Bottom Supply Connection External Shut-Off

Table 11: Gas Pipe Sizing - Capaclty of Pipe

Length of Pipe (ft.)	Nominal Iron Pipe Size	
	1 in.	1-1/4 in.
10	520	1050
20	350	730
30	285	590
40	245	500
50	215	440
60	195	400
70	180	370
80	170	350
90	160	320
100	150	305

NOTE: Maximum capacity of pipe in cubic feet of gas per hour based upon a pressure drop of 0.3 inch W.C. and 0.6 specific gravity gas.

Table 12: Gas Heat Minimum Supply Air

Size (Tons)	Heat Size	Supply Air (CFM)			
		Cooling		Heating	
		Min	Max	Min	Max
180	24	4500	7000	4500	7000
(15)	32	4500	7000	4500	7000
210	24	6000	8750	6000	8750
(17.5)	32	6000	8750	6000	8750
240	24	6000	9400	6000	9400
(20)	32	6000	9400	6000	9400
300	24	7500	12500	7500	12500
(25)	32	7500	12500	7500	12500

Gas Connection

The gas supply line can be routed within the space and roof curb, exiting through the unit’s basepan. Refer to Figure 5 for the gas piping inlet location. Typical supply piping arrangements are shown in Figures 13 and 14. All pipe nipples, fittings, and the gas cock are field supplied.

Gas piping recommendations:

1. A drip leg and a ground joint union must be installed in the gas piping.
2. Where required by local codes, a manual shut-off valve must be installed outside of the unit.
3. Use wrought iron or steel pipe for all gas lines. Pipe dope should be applied sparingly to male threads only.

⚠WARNING

Natural gas may contain some propane. Propane is an excellent solvent and will quickly dissolve white lead and most standard commercial compounds. A special pipe dope must be used when assembling wrought iron or steel pipe. Shellac based compounds such as Gaskolac or Stalastic, and compounds such as Rectorseal #5, Clydes’s or John Crane may be used.

4. All piping should be cleaned of dirt and scale by hammering on the outside of the pipe and blowing out loose particles. Before initial start-up, be sure that all gas lines external to the unit have been purged of air.

5. The gas supply should be a separate line and installed in accordance with all safety codes as prescribed under “Limitations”.
6. A 1/8-inch NPT plugged tapping, accessible for test gage connection, must be installed immediately upstream of the gas supply connection to the unit.
7. After the gas connections have been completed, open the main shut-off valve admitting *normal gas pressure* to the mains. *Check all joints for leaks with soap solution or other material suitable for the purpose.* **NEVER USE A FLAME.**

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

⚠ CAUTION

The furnace and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing at pressures in excess of 1/2 PSIG.

Pressures greater than 1/2 PSIG will cause gas valve damage resulting in a hazardous condition. If it is subjected to a pressure greater than 1/2 PSIG, the gas valve must be replaced.

The furnace must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG.

⚠WARNING

Threaded joints should be coated with a sealing compound that is resistant to the action of liquefied petroleum gases. **Do not use Teflon tape.**

Lp Units, Tanks And Piping

All gas heat units are shipped from the factory equipped for natural gas use only. The unit may be converted in the field for use with LP gas with accessory kit model number 1NP0418.

All LP gas equipment must conform to the safety standards of the National Fire Protection Association.

For satisfactory operation, LP gas pressure must be 10.0 inch W.C. at the unit under full load. Maintaining proper gas pressure depends on three main factors:

1. The vaporization rate which depends on the temperature of the liquid and the “wetted surface” area of the container(s).
2. The proper pressure regulation. (Two-stage regulation is recommended).
3. The pressure drop in the lines between regulators and between the second stage regulator and the appliance. Pipe size required will depend on the length of the pipe run and the total load of all appliances.

Complete information regarding tank sizing for vaporization, recommended regulator settings, and pipe sizing is available from most regulator manufacturers and LP gas suppliers.

⚠WARNING

LP gas is an excellent solvent and will quickly dissolve white lead and most standard commercial compounds. A special pipe dope must be used when assembling wrought iron or steel pipe for LP. Shellac base compounds such as Gaskolac or Stalastic, and compounds such as Rectorseal #5, Clyde’s, or John Crane may be used.

Check all connections for leaks when piping is completed using a soap solution. **NEVER USE A FLAME.**

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

Vent And Combustion Air

Two vent hoods and a combustion air hood (with screens) are shipped attached to the blower housing in the blower compartment. These hoods must be installed to assure proper unit function. All hoods must be fastened to the outside of the gas heat access panel with the screws provided in the bag also attached to the blower housing.

The screen for the combustion air intake hood is secured to the inside of the access panel opening with four fasteners and the screws used for mounting the hood to the panel. The top flange of this hood slips in under the top of the access panel opening when installing. Refer to Vent and Combustion Air Hood Figure 15.

Each vent hood is installed by inserting the top flange of the hood into the slotted opening in the access panel and securing in place.

The products of combustion are discharged horizontally through these two screened, hooded vent openings on the upper gas heat access panel.

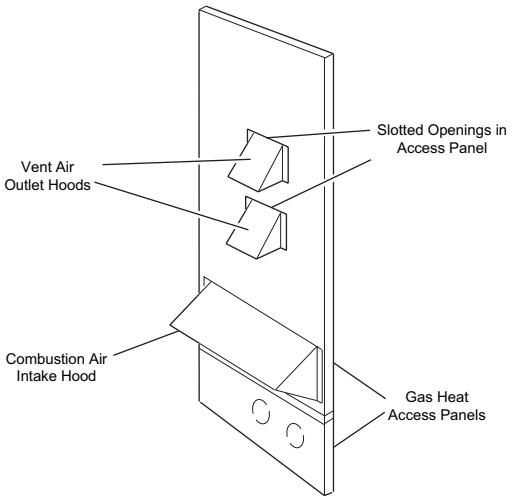


Figure 15: Vent and Combustion Air Hood

Options/Accessories

Electric Heat

Electric heaters are available as a factory-installed option. These heaters mount in the heat compartment with the heating elements extending into the supply air chamber. All electric heaters are fused and intended for use with single point power supply.

Economizer/Motorized Outdoor Damper Rain Hood

The instruction for the optional economizer/motorized damper rain hood can be found in the rain hood kit. Use these instructions when field assembling an economizer rain hood onto a unit. The outdoor and return air dampers, the damper actuator, the damper linkage, the outdoor and return air divider baffles, and all the control sensors are factory mounted as part of the “Factory installed” economizer option.

Power Exhaust/Barometric Relief Damper and Rain Hood

The instructions for the power exhaust/barometric relief damper and rain hood can be found in the rain hood kit. The exhaust fan, all supporting brackets, angles, and the wiring are factory installed as part of the power exhaust option.

Economizer And Power Exhaust Set Point Adjustments

Remove the top rear access panel from the unit. Locate the economizer control module, where the following adjustments will be made.

⚠ CAUTION

Extreme care must be exercised in turning all set point, maximum and minimum damper positioning adjustment screws to prevent twisting them off.

Minimum Position Adjustment

- Check that the damper blades move smoothly without binding; carefully turn the Minimum Position Adjust screw (found on the damper control module) fully clockwise and then set the thermostat indoor fan switch to the ON position and then OFF or energize and de-energize terminals “R” to “G”.
- With the thermostat set to the indoor fan ON position or terminals “R” to “G” energized, turn the Minimum Position Adjusting screw (located on the damper control module) counterclockwise until the desired minimum damper position has been attained.

Enthalpy Set Point Adjustment

- The enthalpy set point may now be set by selecting the desired set point shown in the Enthalpy Set Point Adjustment Figure 16. Adjust as follows:
- For a single enthalpy operation carefully turn the set point adjusting screw (found on the damper control module) to the “A”, “B”, “C” or “D” setting corresponding to the lettered curve of the Enthalpy Set Point Adjustment Figure 17.
- For a dual enthalpy operation, carefully turn the set point adjusting screw fully clockwise past the "D" setting.

Power Exhaust Damper Set Point (With Or Without Power Exhaust)

- With no power exhaust option, adjust the Exhaust Air Adjustment Screw fully clockwise. This will allow 2nd stage cooling to operate.
- With power exhaust option, each building pressurization requirement will be different. The point at which the power exhaust comes on is determined by the economizer damper position (Percent Open). The Exhaust Air Adjustment Screw should be set at the Percent Open of the economizer damper at which the power exhaust is needed. It can be set from 0 to 100% damper open.

Indoor Air Quality AQ

Indoor Air Quality (indoor sensor input): Terminal AQ accepts a +2 to +10 Vdc signal with respect to the (AQ1) terminal. When the signal is below it's set point, the actuator is allowed to modulate normally in accordance with the enthalpy and mixed air sensor inputs. When the AQ signal exceeds it's set point setting and there is no call for free cooling, the actuator is proportionately modulated from the 2 to 10 Vdc signal, with 2 Vdc corresponding to full closed and 10 Vdc corresponding to full open. When there is no call for free cooling, the damper position is limited by the IAQ Max damper position setting. When the signal exceeds it's set point (Demand Control Ventilation Set Point) setting and there is a call for free cooling, the actuator modulates from the minimum position to the full open position based on the highest call from either the mixed air sensor input or the AQ voltage input.

- Optional CO_2 Space Sensor Kit Part # 2AQ04700324
- Optional CO_2 Sensor Kit Part # 2AQ04700424

Replace the top rear access panel on the unit.

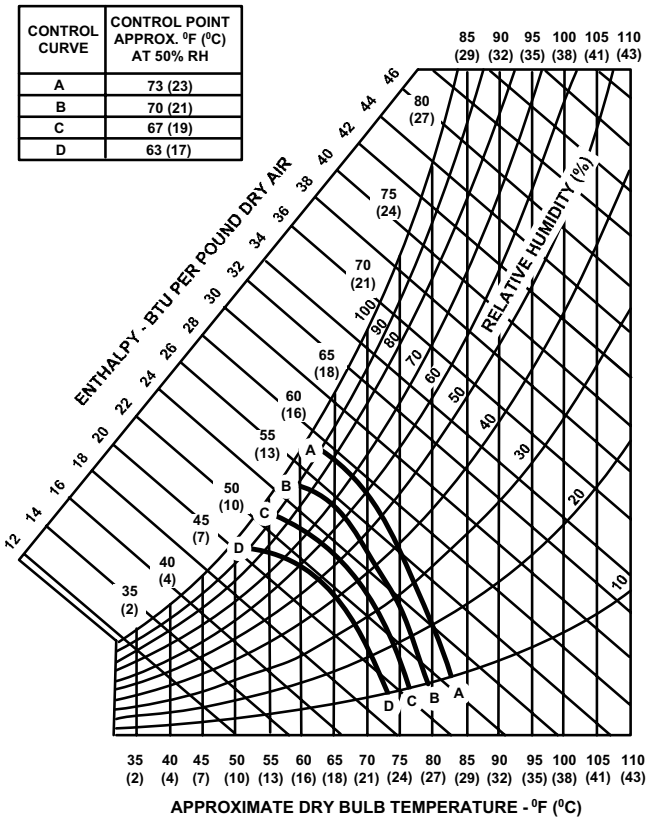


Figure 16: Enthalpy Set Point Chart

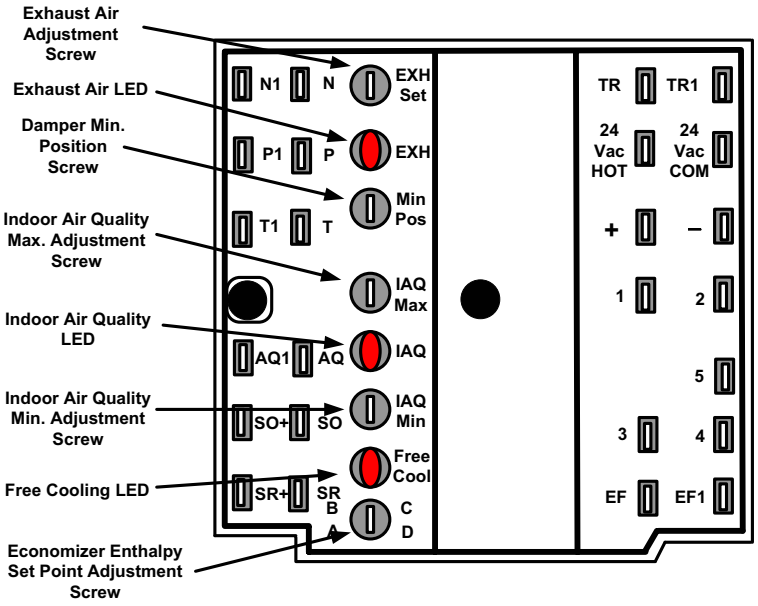


Figure 17: Honeywell Economizer Control W7212

Phasing

York® Model ZJ units are properly phased at the factory. Check for proper compressor rotation. If the blower or compressors rotate in the wrong direction at start-up, the electrical connection to the unit is misphased. Change the phasing of the **Field Line Connection at the factory or field supplied disconnect** to obtain proper rotation. (Scroll compressors operate in only one direction. If the scroll is drawing low amperage, has similar suction and discharge pressures, or producing a high noise level, the scroll is misphased.)

⚠ CAUTION

Scroll compressors require proper rotation to operate correctly. Units are properly phased at the factory. Do not change the internal wiring to make the blower condenser fans, or compressor rotate correctly.

Blower Rotation

Check for proper supply air blower rotation. If the blower is rotating backwards, the line voltage at the unit point of power connection is misphased (See 'PHASING').

Belt Tension

The tension on the belt should be adjusted as shown in Figure 18.

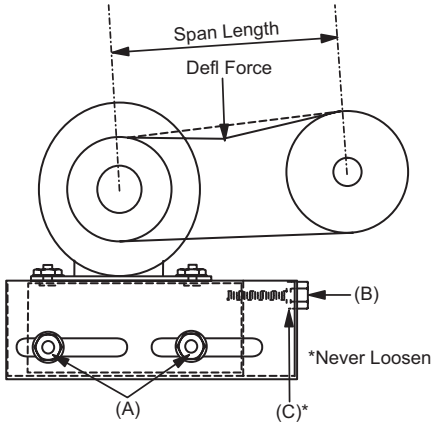


Figure 18: Belt Adjustment

⚠ CAUTION

Procedure for adjusting belt tension:

1. Loosen six nuts (top and bottom) A.
2. Adjust by turning (B).
3. Never loosen nuts (C).
4. Use belt tension checker to apply a perpendicular force to one belt at the midpoint of the span as shown. Deflection distance of 4mm (5/32") is obtained.

To determine the deflection distance from normal position, use a straight edge from sheave to sheave as reference line. The recommended deflection force is as follows:

Tension new belts at the max. deflection force recommended for the belt section. Check the belt tension at least two times during the first 24 hours of operation. Any retensioning should fall between the min. and max. deflection force values.

5. After adjusting retighten nuts (A).

CFM Static Pressure and Power-Altitude and Temperature Corrections

The information below should be used to assist in application of product when being applied at altitudes at or exceeding 1000 feet above sea level.

The air flow rates listed in the standard blower performance tables are based on standard air at sea level. As the altitude or temperature increases, the density of air decreases. In order to use the indoor blower tables for high altitude applications, certain corrections are necessary.

A centrifugal fan is a "constant volume" device. This means that, if the rpm remains constant, the CFM delivered is the same regardless of the density of the air. However, since the air at high altitude is less dense, less static pressure will be generated and less power will be required than a similar application at sea level. Air density correction factors are shown in Table 13 and Figure 19.

Table 13: Altitude/Temperature Correction Factors

Air Temp.	Altitude (Ft.)										
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
40	1.060	1.022	0.986	0.950	0.916	0.882	0.849	0.818	0.788	0.758	0.729
50	1.039	1.002	0.966	0.931	0.898	0.864	0.832	0.802	0.772	0.743	0.715
60	1.019	0.982	0.948	0.913	0.880	0.848	0.816	0.787	0.757	0.729	0.701
70	1.000	0.964	0.930	0.896	0.864	0.832	0.801	0.772	0.743	0.715	0.688
80	0.982	0.947	0.913	0.880	0.848	0.817	0.787	0.758	0.730	0.702	0.676
90	0.964	0.929	0.897	0.864	0.833	0.802	0.772	0.744	0.716	0.689	0.663
100	0.946	0.912	0.880	0.848	0.817	0.787	0.758	0.730	0.703	0.676	0.651

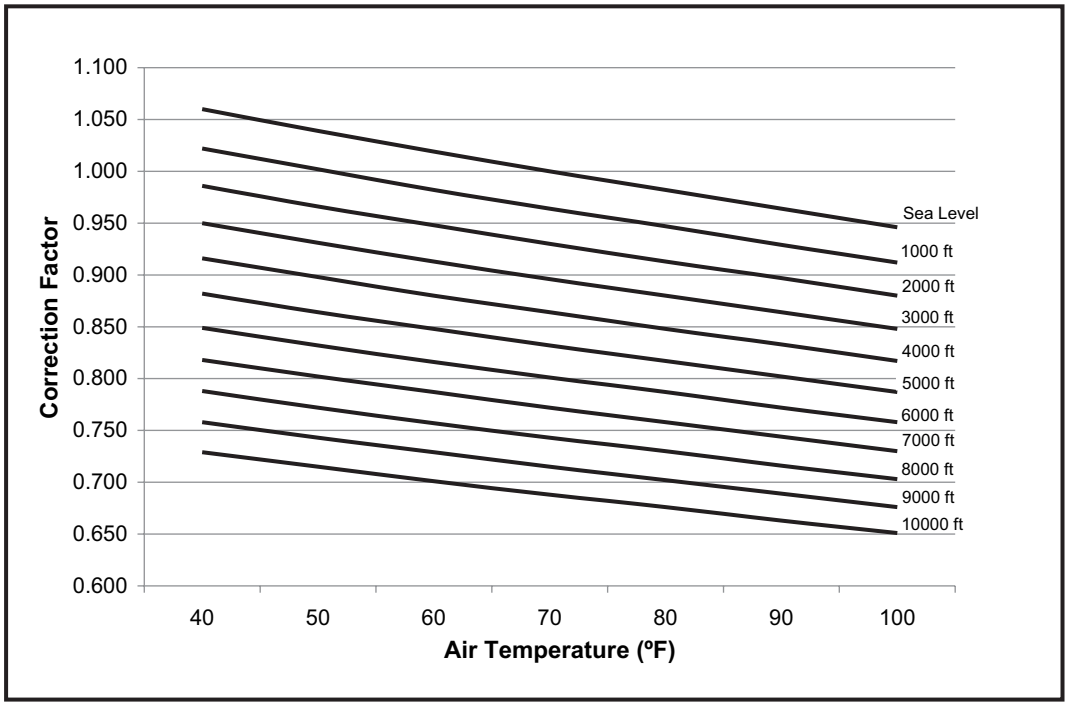


Figure 19: Altitude/Temperature Correction Factors

The examples below will assist in determining the airflow performance of the product at altitude.

Example 1: What are the corrected CFM, static pressure, and BHP at an elevation of 5,000 ft. if the blower performance data is 6,000 CFM, 1.5 IWC and 4.0 BHP?

Solution: At an elevation of 5,000 ft. the indoor blower will still deliver 6,000 CFM if the rpm is unchanged. However, Table 13 must be used to determine the static pressure and BHP. Since no temperature data is given, we will assume an air temperature of 70°F. Table 14 shows the correction factor to be 0.832.

Corrected static pressure = 1.5 x 0.832 = 1.248 IWC

Corrected BHP = 4.0 x 0.832 = 3.328

Example 2: A system, located at 5,000 feet of elevation, is to deliver 6,000 CFM at a static pressure of 1.5". Use the unit blower tables to select the blower speed and the BHP requirement.

Solution: As in the example above, no temperature information is given so 70°F is assumed.

The 1.5" static pressure given is at an elevation of 5,000 ft. The first step is to convert this static pressure to equivalent sea level conditions.

Sea level static pressure = 1.5 / .832 = 1.80"

Enter the blower table at 6000 sCFM and static pressure of 1.8". The rpm listed will be the same rpm needed at 5,000 ft.

Suppose that the corresponding BHP listed in the table is 3.2. This value must be corrected for elevation.

BHP at 5,000 ft. = 3.2 x .832 = 2.66

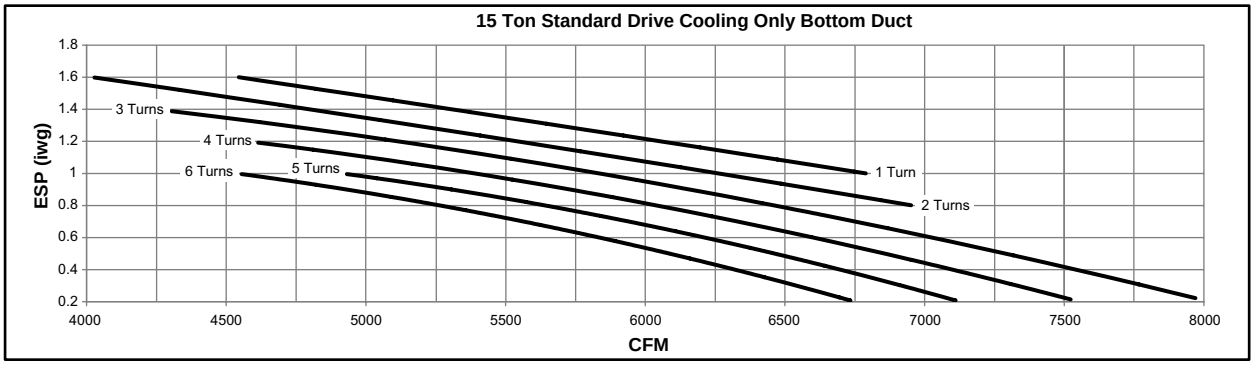
Table 14: ZJ Cooling Only Bottom Duct Blower Performance

ZJ180 (15 Ton) Standard Drive Cooling Only Bottom Duct Blower Performance

15 Ton Standard Drive Cooling Only Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]																							
	1 Turn				2 Turns				3 Turns				4 Turns				5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.2	-	-	-	-	-	-	-	-	7970	1001	5105	5.68	7523	961	4574	5.09	7111	917	4064	4.52	6735	868	3576	3.98
0.4	-	-	-	-	-	-	-	-	7583	1002	4921	5.48	7136	962	4391	4.89	6725	918	3881	4.32	6348	868	3393	3.78
0.6	-	-	-	-	-	-	-	-	7075	1002	4627	5.15	6628	963	4096	4.56	6217	918	3587	3.99	5840	869	3099	3.45
0.8	-	-	-	-	6952	1037	4785	5.33	6470	1002	4233	4.71	6023	963	3702	4.12	5611	918	3193	3.55	5235	869	2705	3.01
1.0	6789	1067	4878	5.43	6272	1037	4304	4.79	5790	1002	3752	4.18	5344	962	3221	3.58	4932	918	2711	3.02	4555	869	2224	2.47
1.2	6060	1067	4321	4.81	5543	1037	3747	4.17	5061	1002	3195	3.56	4614	962	2664	2.97	-	-	-	-	-	-	-	-
1.4	5304	1067	3701	4.12	4787	1037	3128	3.48	4305	1002	2575	2.87	-	-	-	-	-	-	-	-	-	-	-	-
1.6	4545	1067	3030	3.37	4028	1037	2456	2.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Blower performance includes two-inch throwaway filters and no electric heat.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "1 Turn Open" is fully closed. DO NOT close the pulley below one turn open.
4. W = Watts

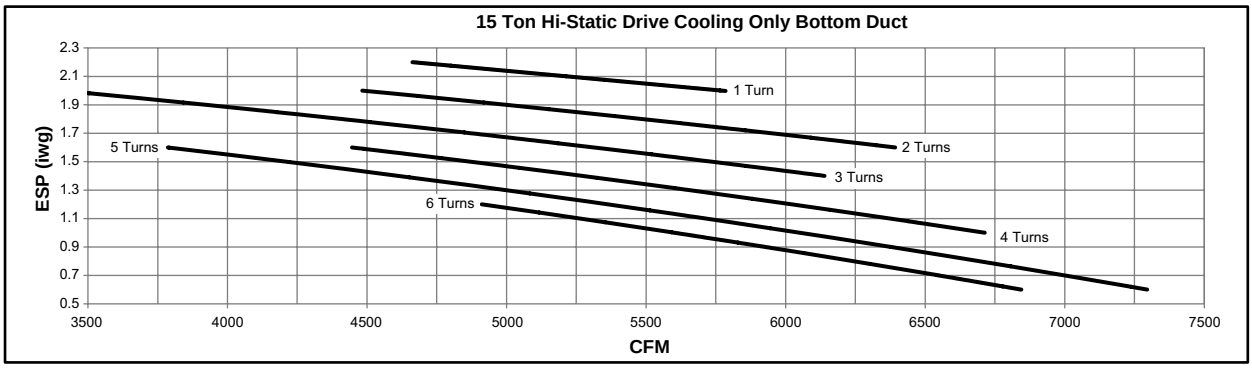


ZJ180 (15 Ton) Hi-Static Drive Cooling Only Bottom Duct Blower Performance

15 Ton Hi-Static Drive Cooling Only Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]																							
	1 Turn				2 Turns				3 Turns				4 Turns				5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7295	1022	4946	5.50	6844	978	4379	4.87
0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6694	1022	4518	5.03	6243	978	3951	4.40
1.0	-	-	-	-	-	-	-	-	-	-	-	-	6713	1065	4820	5.37	6053	1022	4038	4.49	5602	978	3472	3.86
1.2	-	-	-	-	-	-	-	-	-	-	-	-	6022	1066	4276	4.76	5362	1023	3493	3.89	4911	979	2927	3.26
1.4	-	-	-	-	-	-	-	-	6139	1110	4650	5.18	5270	1067	3652	4.07	4610	1024	2870	3.19	-	-	-	-
1.6	-	-	-	-	6392	1152	5149	5.73	5315	1110	3935	4.38	4446	1067	2938	3.27	3786	1024	2156	2.40	-	-	-	-
1.8	-	-	-	-	5485	1152	4329	4.82	4407	1110	3116	3.47	-	-	-	-	-	-	-	-	-	-	-	-
2	5770	1192	4821	5.37	4483	1150	3392	3.78	3406	1108	2179	2.42	-	-	-	-	-	-	-	-	-	-	-	-
2.2	4663	1188	3752	4.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Blower performance includes two-inch throwaway filters and no electric heat.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "1 Turn Open" is fully closed. DO NOT close the pulley below one turn open.
4. W = Watts

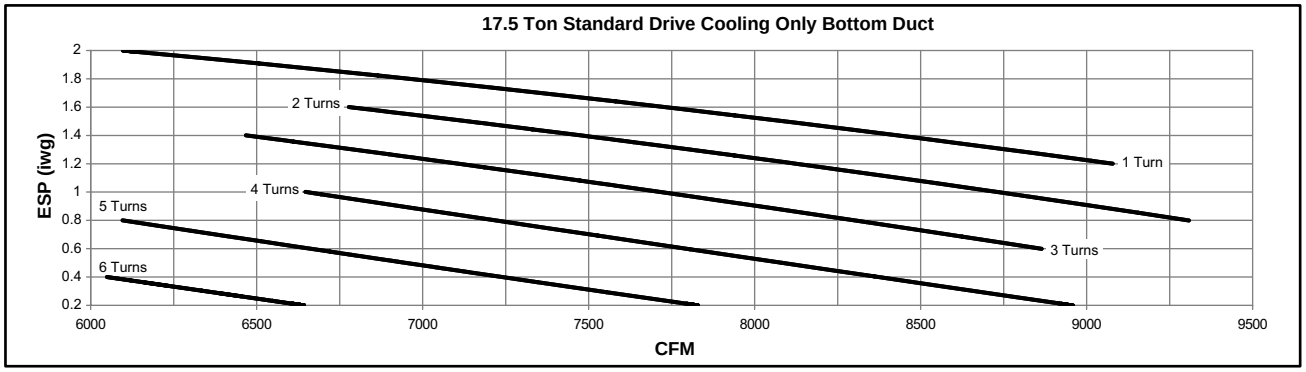


ZJ210 (17.5 Ton) Standard Drive Cooling Only Bottom Duct Blower Performance

17.5 Ton Standard Drive Cooling Only Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]																							
	1 Turn				2 Turns				3 Turns				4 Turns				5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.2	-	-	-	-	-	-	-	-	-	-	-	-	8959	932	4402	5.25	7830	900	3173	3.79	6642	869	1872	2.23
0.4	-	-	-	-	-	-	-	-	-	-	-	-	8366	932	4272	5.10	7237	900	3044	3.63	6049	869	1743	2.08
0.6	-	-	-	-	-	-	-	-	8864	964	5279	6.30	7794	932	4124	4.92	6664	900	2895	3.46	-	-	-	-
0.8	-	-	-	-	9308	996	6187	7.38	8296	964	5104	6.09	7226	932	3948	4.71	6096	901	2720	3.25	-	-	-	-
1.0	-	-	-	-	8730	996	5978	7.13	7718	964	4895	5.84	6647	933	3739	4.46	-	-	-	-	-	-	-	-
1.2	9079	1028	6738	8.04	8125	996	5728	6.84	7113	965	4645	5.54	-	-	-	-	-	-	-	-	-	-	-	-
1.4	8433	1028	6439	7.68	7480	996	5429	6.48	6468	965	4346	5.19	-	-	-	-	-	-	-	-	-	-	-	-
1.6	7731	1028	6085	7.26	6778	996	5075	6.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.8	6957	1028	5667	6.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	6097	1027	5180	6.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Blower performance includes two-inch throwaway filters and no electric heat.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "1 Turn Open" is fully closed. DO NOT close the pulley below one turn open.
4. W = Watts

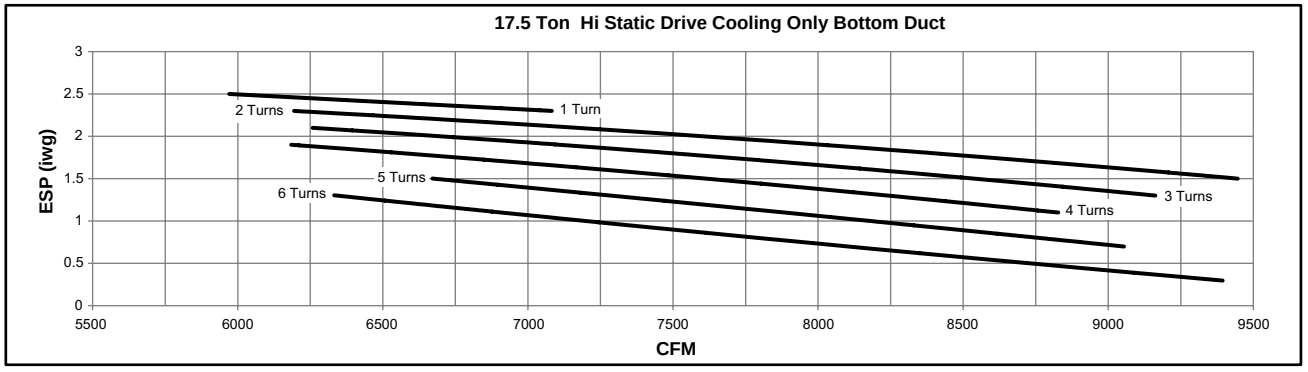


ZJ210 (17.5 Ton) Hi-Static Drive Cooling Only Bottom Duct Blower Performance

17.5 Ton Hi-Static Drive Cooling Only Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]																							
	1 Turn				2 Turns				3 Turns				4 Turns				5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9394	950	5111	6.10
0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8716	950	4900	5.85
0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9055	981	5825	6.95	8093	950	4689	5.60
0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8464	981	5605	6.69	7502	950	4469	5.33
1.1	-	-	-	-	-	-	-	-	-	-	-	-	8828	1014	6371	7.60	7884	981	5367	6.41	6923	950	4231	5.05
1.3	-	-	-	-	-	-	-	-	9162	1048	6976	8.33	8237	1014	6105	7.29	7294	981	5101	6.09	6332	950	3965	4.73
1.5	-	-	-	-	9446	1082	7413	8.85	8539	1048	6674	7.97	7615	1014	5803	6.93	6671	981	4799	5.73	-	-	-	-
1.7	-	-	-	-	8769	1082	7065	8.43	7862	1048	6327	7.55	6938	1014	5456	6.51	-	-	-	-	-	-	-	-
1.9	-	-	-	-	8016	1082	6664	7.95	7109	1048	5925	7.07	6184	1015	5054	6.03	-	-	-	-	-	-	-	-
2.1	-	-	-	-	7165	1083	6198	7.40	6258	1048	5460	6.52	-	-	-	-	-	-	-	-	-	-	-	-
2.3	7083	1119	6266	7.48	6195	1083	5660	6.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.5	5971	1119	5647	6.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Blower performance includes two-inch throwaway filters and no electric heat.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "1 Turn Open" is fully closed. DO NOT close the pulley below one turn open.
4. W = Watts

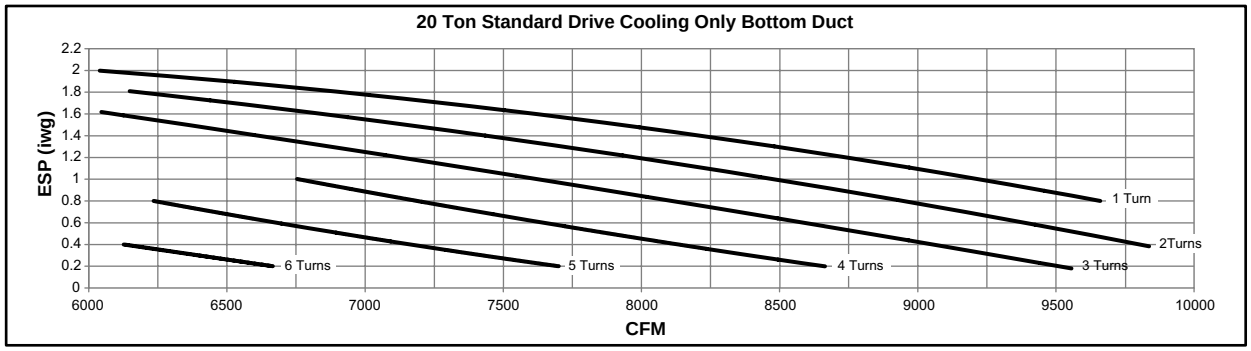


ZJ240 (20 Ton) Standard Drive Cooling Only Bottom Duct Blower Performance

20 Ton Standard Drive Cooling Only Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]																							
	1 Turn				2 Turns				3 Turns				4 Turns				5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.2	-	-	-	-	-	-	-	-	9556	964	5557	6.63	8664	932	4401	5.25	7701	900	3172	3.79	6666	868	1872	2.23
0.4	-	-	-	-	9838	996	6515	7.78	9017	964	5430	6.48	8125	932	4273	5.10	7161	900	3045	3.63	6126	868	1745	2.08
0.6	-	-	-	-	9358	996	6367	7.60	8537	964	5282	6.30	7645	932	4125	4.92	6682	900	2897	3.46	-	-	-	-
0.8	9660	1027	7205	8.60	8911	996	6192	7.39	8090	964	5106	6.09	7198	932	3949	4.71	6234	901	2721	3.25	-	-	-	-
1.0	9216	1027	6995	8.35	8467	996	5981	7.14	7646	964	4896	5.84	6754	933	3739	4.46	-	-	-	-	-	-	-	-
1.2	8746	1028	6743	8.05	7997	996	5729	6.84	7176	965	4644	5.54	-	-	-	-	-	-	-	-	-	-	-	-
1.4	8223	1028	6442	7.69	7473	996	5429	6.48	6652	965	4343	5.18	-	-	-	-	-	-	-	-	-	-	-	-
1.6	7616	1028	6087	7.26	6866	996	5073	6.05	6046	965	3988	4.76	-	-	-	-	-	-	-	-	-	-	-	-
1.8	6898	1028	5668	6.77	6148	996	4655	5.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.0	6040	1027	5181	6.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Blower performance includes two-inch throwaway filters and no electric heat.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "1 Turn Open" is fully closed. DO NOT close the pulley below one turn open.
4. W = Watts

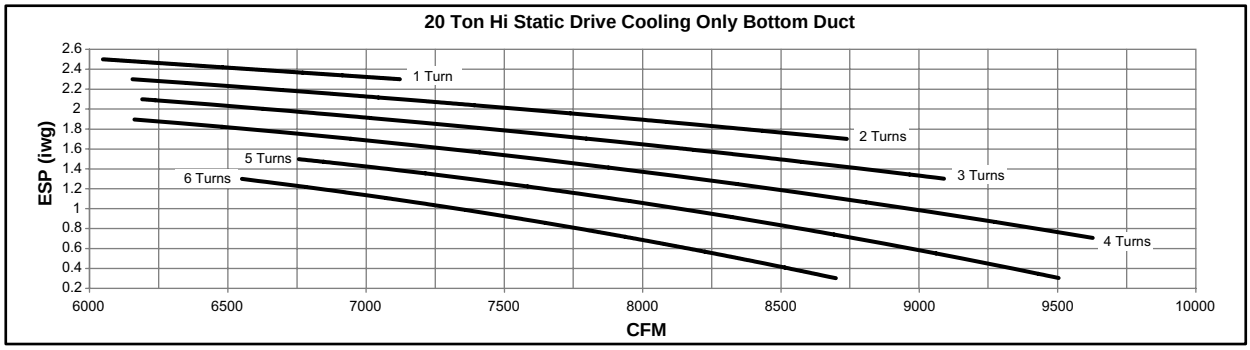


ZJ240 (20 Ton) Hi-Static Drive Cooling Only Bottom Duct Blower Performance

20 Ton Hi-Static Drive Cooling Only Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]																							
	1 Turn				2 Turns				3 Turns				4 Turns				5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9504	981	6105	7.29	8698	949	4981	5.95
0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9159	981	5967	7.12	8353	949	4844	5.78
0.7	-	-	-	-	-	-	-	-	-	-	-	-	9627	1014	6801	8.12	8781	982	5804	6.93	7975	950	4681	5.59
0.9	-	-	-	-	-	-	-	-	-	-	-	-	9206	1014	6609	7.89	8360	982	5612	6.70	7555	950	4488	5.36
1.1	-	-	-	-	-	-	-	-	-	-	-	-	8735	1014	6381	7.62	7889	982	5384	6.43	7083	950	4261	5.09
1.3	-	-	-	-	-	-	-	-	9089	1048	6986	8.34	8203	1014	6114	7.30	7357	981	5117	6.11	6551	950	3994	4.77
1.5	-	-	-	-	-	-	-	-	8489	1048	6674	7.97	7603	1014	5803	6.93	6757	981	4806	5.74	-	-	-	-
1.7	-	-	-	-	8738	1082	7058	8.42	7812	1048	6313	7.53	6926	1014	5442	6.49	-	-	-	-	-	-	-	-
1.9	-	-	-	-	7975	1082	6643	7.93	7049	1048	5897	7.04	6162	1014	5026	6.00	-	-	-	-	-	-	-	-
2.1	-	-	-	-	7117	1083	6168	7.36	6190	1048	5422	6.47	-	-	-	-	-	-	-	-	-	-	-	-
2.3	7122	1119	6248	7.46	6155	1083	5628	6.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.5	6048	1120	5639	6.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Blower performance includes two-inch throwaway filters and no electric heat.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "1 Turn Open" is fully closed. DO NOT close the pulley below one turn open.
4. W = Watts



ZJ300 (25 Ton) Standard Drive Cooling Only Bottom Duct Blower Performance

25 Ton Standard Drive Cooling Only Bottom Duct Blower Performance[1]

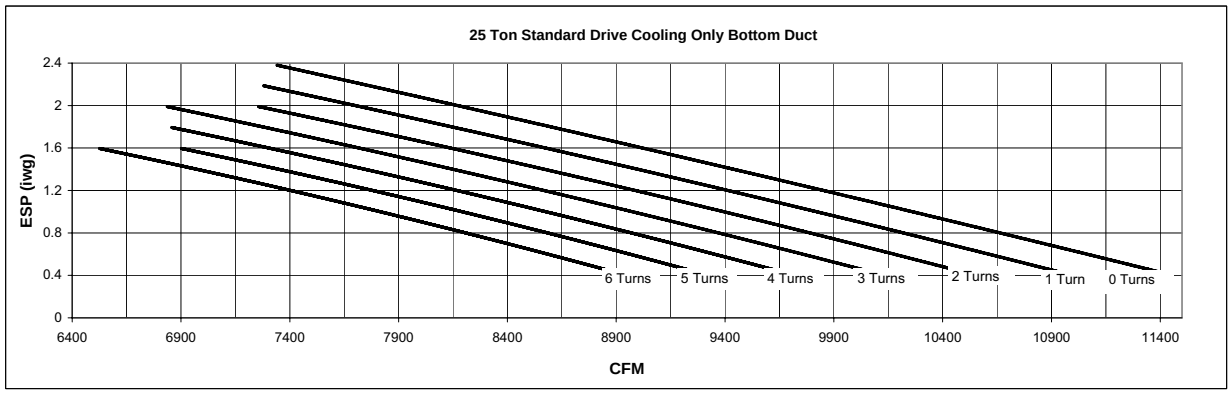
ESP[2]	Turns Open[3]																			
	0 Turns				1 Turn				2 Turns				3 Turns				4 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.4	11416	1365	10722	12.22	10967	1329	9910	11.30	10532	1291	9141	10.42	10112	1254	8413	9.59	9707	1216	7726	8.81
0.6	11071	1365	10315	11.76	10622	1329	9503	10.83	10187	1291	8734	9.96	9767	1254	8006	9.13	9362	1216	7319	8.34
0.8	10694	1365	9932	11.32	10245	1329	9120	10.40	9810	1291	8350	9.52	9390	1254	7622	8.69	8985	1217	6936	7.91
1	10292	1365	9561	10.90	9843	1329	8749	9.97	9408	1292	7979	9.09	8988	1254	7251	8.27	8582	1217	6565	7.48
1.2	9871	1365	9190	10.48	9422	1329	8378	9.55	8987	1291	7608	8.67	8567	1254	6880	7.84	8162	1217	6194	7.06
1.4	9439	1365	8808	10.04	8990	1329	7996	9.11	8555	1291	7227	8.24	8135	1254	6499	7.41	7730	1216	5812	6.63
1.6	9002	1365	8404	9.58	8553	1329	7592	8.65	8118	1291	6822	7.78	7698	1254	6094	6.95	7292	1216	5408	6.16
1.8	8567	1365	7965	9.08	8118	1329	7154	8.15	7683	1291	6384	7.28	7263	1254	5656	6.45	6857	1216	4970	5.66
2	8140	1365	7481	8.53	7691	1329	6669	7.60	7256	1291	5900	6.72	6836	1254	5171	5.89	–	–	–	–
2.2	7729	1365	6940	7.91	7280	1329	6128	6.98	–	–	–	–	–	–	–	–	–	–	–	–
2.4	7341	1365	6329	7.21	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

1. Blower performance includes two-inch throwaway filters and no electric heat.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "0 Turns Open" is fully closed.
4. W = Watts

25 Ton Standard Drive Cooling Only Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]							
	5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.4	9316	1179	7082	8.07	8939	1140	6480	7.39
0.6	8971	1179	6675	7.61	8595	1140	6073	6.92
0.8	8594	1179	6292	7.17	8218	1140	5689	6.48
1	8192	1179	5921	6.75	7815	1140	5318	6.06
1.2	7771	1179	5550	6.33	7395	1140	4947	5.64
1.4	7339	1179	5168	5.89	6963	1140	4566	5.20
1.6	6902	1179	4764	5.43	6525	1140	4161	4.74
1.8	–	–	–	–	–	–	–	–
2	–	–	–	–	–	–	–	–
2.2	–	–	–	–	–	–	–	–
2.4	–	–	–	–	–	–	–	–

1. Blower performance includes two-inch throwaway filters and maximum number of heat tubes available for each tonnage.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "0 Turns Open" is fully closed.
4. W = Watts



ZJ300 (25 Ton) Hi-Static Drive Cooling Only Bottom Duct Blower Performance

25 Ton Hi-Static Drive Cooling Only Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]																			
	0 Turns				1 Turn				2 Turns				3 Turns				4 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
0.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	11619	1180	12096	13.79
0.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	11282	1180	11688	13.32
1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10931	1181	11268	12.84
1.2	–	–	–	–	–	–	–	–	–	–	–	–	11034	1210	11851	13.51	10569	1182	10836	12.35
1.4	–	–	–	–	–	–	–	–	–	–	–	–	10662	1211	11407	13.00	10197	1183	10392	11.85
1.6	–	–	–	–	–	–	–	–	10781	1240	11999	13.68	10281	1212	10952	12.48	9816	1184	9937	11.33
1.8	–	–	–	–	–	–	–	–	10394	1241	11534	13.15	9894	1214	10486	11.95	9429	1186	9471	10.80
2	–	–	–	–	10536	1270	12136	13.83	10001	1243	11057	12.60	9501	1216	10010	11.41	9036	1188	8995	10.25
2.2	–	–	–	–	10140	1272	11650	13.28	9605	1246	10571	12.05	9105	1219	9524	10.86	8640	1190	8509	9.70
2.4	–	–	–	–	9742	1276	11155	12.71	9207	1250	10075	11.48	8707	1222	9028	10.29	8242	1194	8013	9.13
2.6	9913	1305	11761	13.41	9343	1280	10650	12.14	8808	1254	9571	10.91	8308	1227	8524	9.72	7843	1198	7508	8.56
2.8	9516	1311	11248	12.82	8945	1285	10137	11.55	8410	1259	9058	10.32	7910	1232	8010	9.13	–	–	–	–
3	9120	1317	10727	12.23	8550	1292	9615	10.96	8015	1265	8536	9.73	–	–	–	–	–	–	–	–
3.2	8730	1324	10198	11.62	8159	1299	9086	10.36	–	–	–	–	–	–	–	–	–	–	–	–
3.4	8344	1333	9661	11.01	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

25 Ton Hi-Static Drive Cooling Only Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]							
	5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.4	–	–	–	–	11118	1119	10556	12.03
0.6	11190	1150	11113	12.67	10796	1120	10162	11.58
0.8	10852	1151	10705	12.20	10458	1121	9754	11.12
1	10502	1152	10285	11.72	10108	1121	9334	10.64
1.2	10140	1153	9853	11.23	9745	1122	8902	10.15
1.4	9767	1153	9409	10.72	9373	1123	8458	9.64
1.6	9387	1155	8954	10.21	8993	1124	8003	9.12
1.8	9000	1156	8488	9.68	8606	1126	7537	8.59
2	8607	1158	8012	9.13	8213	1128	7061	8.05
2.2	8211	1161	7526	8.58	7817	1131	6574	7.49
2.4	7813	1165	7030	8.01	–	–	–	–
2.6	–	–	–	–	–	–	–	–
2.8	–	–	–	–	–	–	–	–
3	–	–	–	–	–	–	–	–
3.2	–	–	–	–	–	–	–	–
3.4	–	–	–	–	–	–	–	–

1. Blower performance includes two-inch throwaway filters and maximum number of heat tubes available for each tonnage.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "0 Turns Open" is fully closed.
4. W = Watts

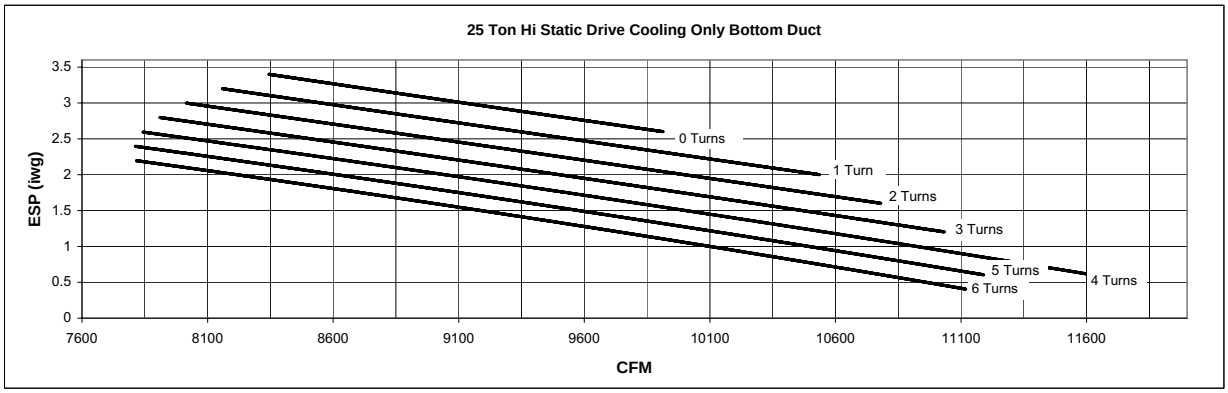


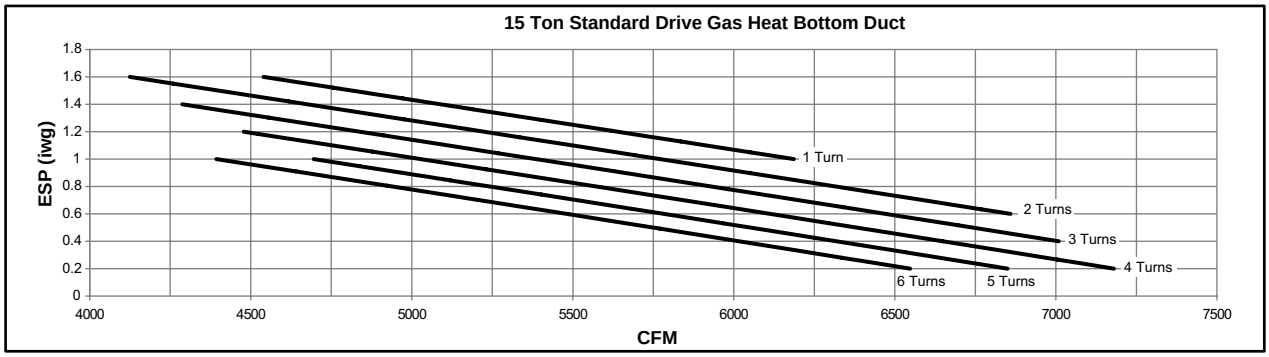
Table 15: ZJ Gas Heat Bottom Duct Blower Performance

ZJ180 (15 Ton) Standard Drive Gas Heat Bottom Duct Blower Performance

15 Ton Standard Drive Gas Heat Bottom Duct Blower Performance[1]

ESP[2]	TURNS OPEN[3]																							
	1 Turn				2 Turns				3 Turns				4 Turns				5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.2	-	-	-	-	-	-	-	-	-	-	-	-	7180	961	4335	4.82	6850	918	3902	4.34	6547	872	3490	3.88
0.4	-	-	-	-	-	-	-	-	7009	999	4402	4.90	6650	961	3948	4.39	6319	918	3515	3.91	6017	871	3104	3.45
0.6	-	-	-	-	6859	1034	4466	4.97	6472	999	3991	4.44	6113	961	3537	3.94	5783	918	3105	3.46	5480	871	2693	3.00
0.8	-	-	-	-	6317	1034	4047	4.50	5930	1000	3572	3.98	5572	961	3118	3.47	5241	919	2685	2.99	4939	872	2274	2.53
1.0	6187	1064	4130	4.60	5772	1034	3634	4.04	5385	1000	3159	3.52	5026	961	2705	3.01	4696	919	2272	2.53	4393	872	1861	2.07
1.2	5639	1065	3739	4.16	5224	1034	3243	3.61	4837	1000	2768	3.08	4478	962	2314	2.58	-	-	-	-	-	-	-	-
1.4	5089	1064	3384	3.77	4674	1034	2888	3.21	4288	1000	2413	2.69	-	-	-	-	-	-	-	-	-	-	-	-
1.6	4540	1064	3082	3.43	4125	1034	2586	2.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Blower performance includes two-inch throwaway filters and maximum number of heat tubes available for each tonnage.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "1 Turn Open" is fully closed. DO NOT close the pulley below one turn open.
4. W = Watts

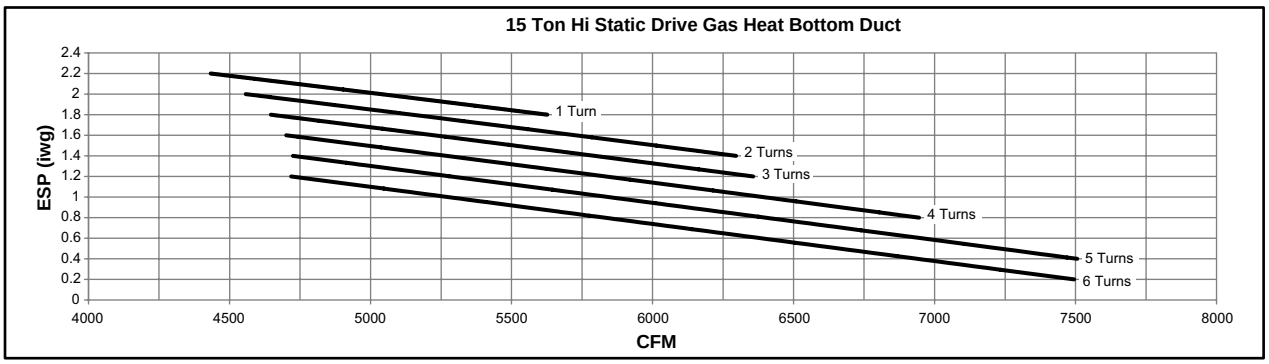


ZJ180 (15 Ton) Hi-Static Drive Gas Heat Bottom Duct Blower Performance

15 Ton Hi-Static Drive Gas Heat Bottom Duct Blower Performance[1]

ESP[2]	TURNS OPEN[3]																							
	1 Turn				2 Turns				3 Turns				4 Turns				5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7495	980	4836	5.38
0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7506	1023	4982	5.55	6938	980	4303	4.79
0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6952	1023	4512	5.02	6383	981	3833	4.27
0.8	-	-	-	-	-	-	-	-	-	-	-	-	6945	1065	4764	5.30	6399	1023	4085	4.55	5830	981	3407	3.79
1.0	-	-	-	-	-	-	-	-	-	-	-	-	6391	1065	4363	4.86	5845	1023	3684	4.10	5276	981	3005	3.35
1.2	-	-	-	-	-	-	-	-	6357	1107	4647	5.17	5833	1065	3968	4.42	5287	1023	3290	3.66	4719	981	2611	2.91
1.4	-	-	-	-	6296	1148	4920	5.48	5795	1106	4241	4.72	5271	1065	3563	3.97	4725	1023	2884	3.21	-	-	-	-
1.6	-	-	-	-	5727	1148	4484	4.99	5225	1106	3805	4.24	4701	1064	3127	3.48	-	-	-	-	-	-	-	-
1.8	5627	1189	4678	5.21	5148	1148	4000	4.45	4646	1106	3322	3.70	-	-	-	-	-	-	-	-	-	-	-	-
2.0	5037	1190	4128	4.59	4558	1148	3449	3.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.2	4433	1190	3492	3.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Blower performance includes two-inch throwaway filters and maximum number of heat tubes available for each tonnage.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "1 Turn Open" is fully closed. DO NOT close the pulley below one turn open.
4. W = Watts

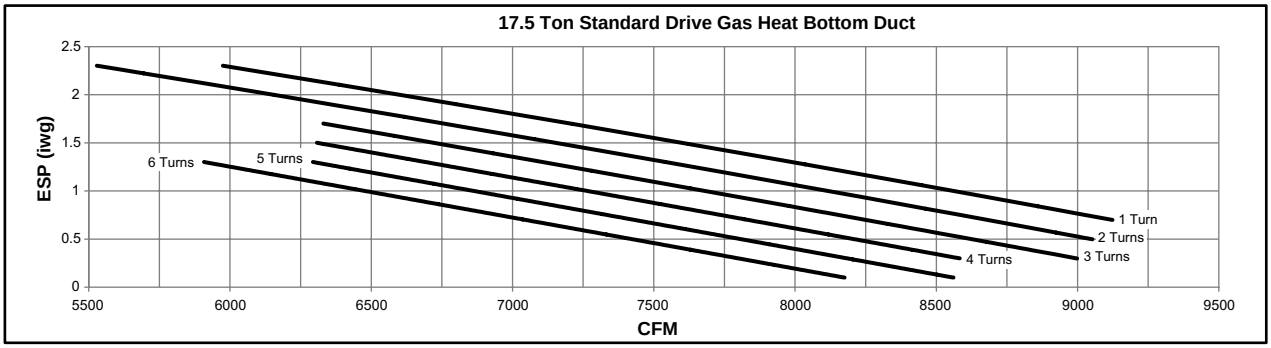


ZJ210 (17.5 Ton) Standard Drive Gas Heat Bottom Duct Blower Performance

17.5 Ton Standard Drive Gas Heat Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]																							
	1 Turn				2 Turns				3 Turns				4 Turns				5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8561	900	5093	6.08	8175	872	4512	5.38
0.3	-	-	-	-	-	-	-	-	8999	961	6008	7.17	8583	929	5408	6.45	8182	900	4817	5.75	7797	871	4236	5.06
0.5	-	-	-	-	9053	993	6335	7.56	8622	960	5725	6.83	8206	929	5125	6.12	7806	900	4534	5.41	7420	871	3952	4.72
0.7	9123	1027	6664	7.95	8677	993	6044	7.21	8246	960	5434	6.49	7831	929	4834	5.77	7430	900	4243	5.06	7044	871	3662	4.37
0.9	8747	1026	6366	7.60	8301	993	5747	6.86	7870	960	5137	6.13	7454	929	4537	5.41	7054	900	3946	4.71	6668	871	3364	4.02
1.1	8369	1026	6062	7.24	7923	993	5443	6.50	7492	960	4833	5.77	7076	929	4233	5.05	6676	899	3642	4.35	6290	871	3060	3.65
1.3	7987	1026	5752	6.87	7541	993	5133	6.13	7110	960	4523	5.40	6694	929	3923	4.68	6294	899	3332	3.98	5908	871	2750	3.28
1.5	7601	1026	5436	6.49	7155	993	4817	5.75	6724	960	4207	5.02	6308	929	3607	4.30	-	-	-	-	-	-	-	-
1.7	7207	1027	5114	6.10	6761	993	4495	5.36	6330	960	3885	4.64	-	-	-	-	-	-	-	-	-	-	-	-
1.9	6806	1027	4787	5.71	6360	993	4168	4.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.1	6396	1027	4455	5.32	5950	993	3835	4.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.3	5975	1027	4117	4.91	5529	993	3498	4.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

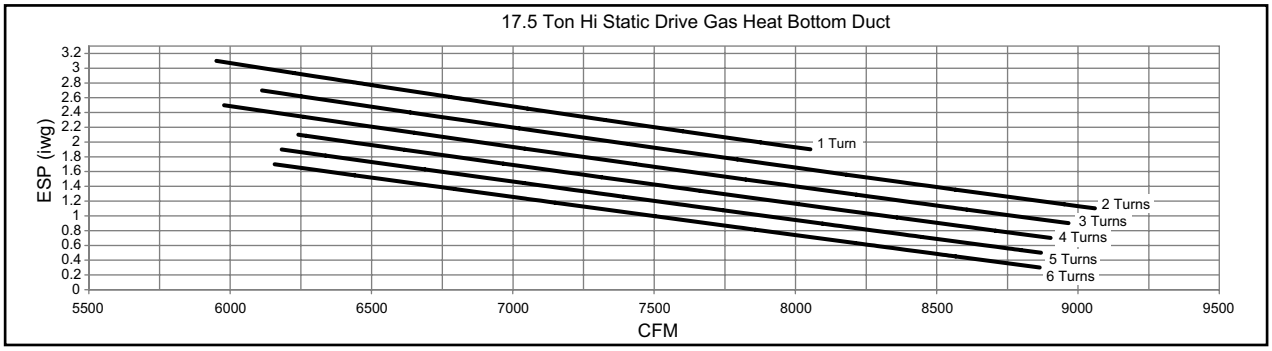
1. Blower performance includes two-inch throwaway filters and maximum number of heat tubes available for each tonnage.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "1 Turn Open" is fully closed. DO NOT close the pulley below one turn open.
4. W = Watts



ZJ210 (17.5 Ton) Hi-Static Drive Gas Heat Bottom Duct Blower Performance

17.5 Ton Hi-Static Drive Gas Heat Bottom Duct Blower Performance[1]																								
ESP[2]	Turns Open[3]																							
	1 Turn				2 Turns				3 Turns				4 Turns				5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8865	949	5733	6.84
0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8869	981	6064	7.24	8472	949	5427	6.48
0.7	-	-	-	-	-	-	-	-	-	-	-	-	8903	1015	6443	7.69	8477	981	5753	6.87	8080	949	5116	6.11
0.9	-	-	-	-	-	-	-	-	8966	1049	6869	8.20	8513	1015	6127	7.31	8087	981	5437	6.49	7689	949	4800	5.73
1.1	-	-	-	-	9060	1084	7344	8.76	8578	1049	6549	7.82	8125	1015	5806	6.93	7699	981	5116	6.11	7301	949	4479	5.35
1.3	-	-	-	-	8675	1084	7019	8.38	8193	1049	6224	7.43	7740	1015	5482	6.54	7314	981	4792	5.72	6916	949	4155	4.96
1.5	-	-	-	-	8294	1083	6692	7.99	7812	1049	5897	7.04	7358	1014	5154	6.15	6932	981	4464	5.33	6535	949	3827	4.57
1.7	-	-	-	-	7916	1083	6361	7.59	7435	1048	5566	6.64	6981	1014	4823	5.76	6555	981	4133	4.93	6157	949	3496	4.17
1.9	8053	1119	6876	8.21	7544	1083	6028	7.19	7062	1048	5233	6.24	6608	1014	4490	5.36	6183	981	3800	4.54	-	-	-	-
2.1	7686	1119	6540	7.81	7176	1083	5692	6.79	6695	1048	4897	5.84	6241	1014	4155	4.96	-	-	-	-	-	-	-	-
2.3	7325	1119	6203	7.40	6815	1083	5355	6.39	6333	1048	4560	5.44	-	-	-	-	-	-	-	-	-	-	-	-
2.5	6970	1119	5865	7.00	6460	1083	5017	5.99	5979	1048	4222	5.04	-	-	-	-	-	-	-	-	-	-	-	-
2.7	6623	1119	5527	6.60	6113	1083	4679	5.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.9	6283	1119	5188	6.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.1	5952	1120	4849	5.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Blower performance includes two-inch throwaway filters and maximum number of heat tubes available for each tonnage.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "1 Turn Open" is fully closed. DO NOT close the pulley below one turn open.
4. W = Watts

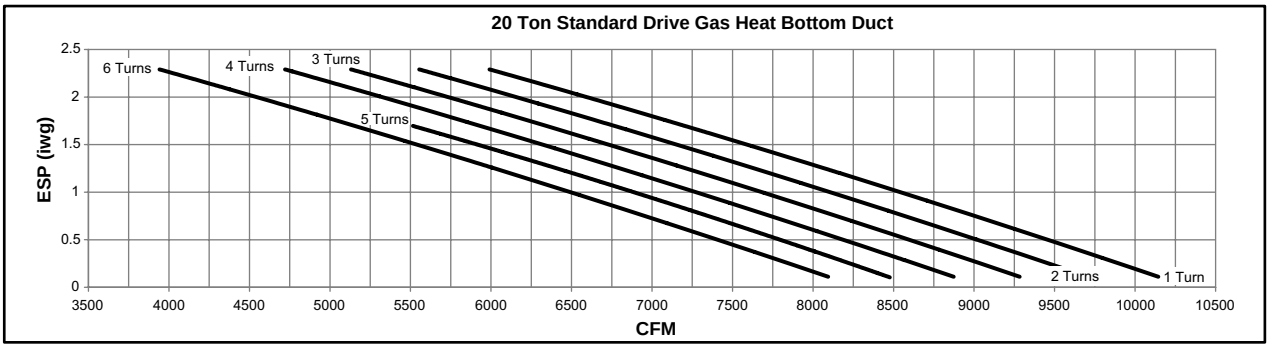


ZJ240 (20 Ton) Standard Drive Gas Heat Bottom Duct Blower Performance

20 Ton Standard Drive Gas Heat Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]																							
	1 Turn				2 Turns				3 Turns				4 Turns				5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.1	10144	1024	7738	9.24	9707	990	7103	8.48	9283	958	6482	7.74	8874	927	5874	7.01	8477	897	5281	6.30	8094	869	4701	5.61
0.3	9814	1025	7377	8.80	9377	992	6741	8.05	8954	959	6120	7.30	8544	928	5512	6.58	8147	899	4919	5.87	7764	871	4339	5.18
0.5	9469	1026	7036	8.40	9032	993	6401	7.64	8608	960	5779	6.90	8198	929	5172	6.17	7802	900	4578	5.46	7419	872	3999	4.77
0.7	9110	1027	6712	8.01	8673	993	6077	7.25	8249	961	5455	6.51	7840	930	4848	5.79	7443	900	4254	5.08	7060	872	3675	4.39
0.9	8739	1027	6400	7.64	8302	993	5764	6.88	7879	961	5143	6.14	7469	930	4535	5.41	7073	900	3942	4.70	6690	872	3362	4.01
1.1	8359	1027	6093	7.27	7922	993	5458	6.51	7499	961	4836	5.77	7089	930	4229	5.05	6693	900	3635	4.34	6310	872	3056	3.65
1.3	7972	1026	5788	6.91	7535	993	5152	6.15	7111	960	4531	5.41	6702	929	3923	4.68	6305	900	3330	3.97	5922	872	2750	3.28
1.5	7579	1026	5478	6.54	7142	992	4843	5.78	6718	960	4221	5.04	6308	929	3614	4.31	5912	900	3020	3.60	5529	871	2441	2.91
1.7	7182	1026	5159	6.16	6745	992	4524	5.40	6322	960	3902	4.66	5912	929	3295	3.93	5515	899	2701	3.22	5132	871	2122	2.53
1.9	6784	1026	4825	5.76	6347	992	4190	5.00	5924	960	3569	4.26	5514	929	2961	3.53	5117	900	2368	2.83	4734	872	1788	2.13
2.1	6386	1027	4472	5.34	5949	993	3837	4.58	5526	961	3215	3.84	5116	930	2608	3.11	4720	900	2014	2.40	4337	872	1435	1.71
2.3	5991	1028	4094	4.89	5554	994	3459	4.13	5131	962	2837	3.39	4721	931	2230	2.66	4325	901	1636	1.95	3941	873	1057	1.26

1. Blower performance includes two-inch throwaway filters and maximum number of heat tubes available for each tonnage.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "1 Turn Open" is fully closed. DO NOT close the pulley below one turn open.
4. W = Watts

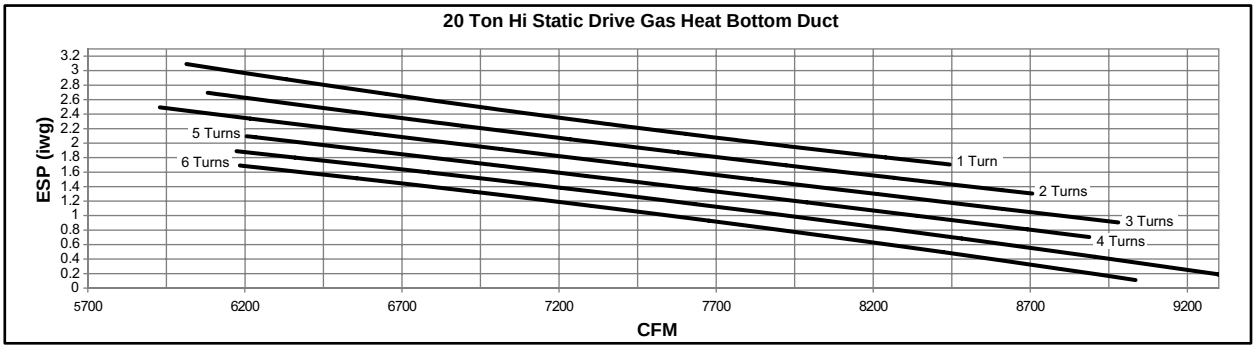


ZJ240 (20 Ton) Hi-Static Drive Gas Heat Bottom Duct Blower Performance

20 Ton Hi-Static Drive Gas Heat Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]																							
	1 Turn				2 Turns				3 Turns				4 Turns				5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9416	980	6851	8.18	9035	949	6238	7.45
0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9128	980	6513	7.77	8748	949	5901	7.04
0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8812	980	6174	7.37	8431	949	5561	6.64
0.7	-	-	-	-	-	-	-	-	-	-	-	-	8888	1013	6488	7.74	8472	980	5833	6.96	8091	950	5221	6.23
0.9	-	-	-	-	-	-	-	-	8980	1047	6845	8.17	8528	1013	6147	7.34	8112	980	5492	6.56	7731	950	4880	5.82
1.1	-	-	-	-	-	-	-	-	8605	1047	6505	7.76	8153	1013	5807	6.93	7736	980	5152	6.15	7356	950	4540	5.42
1.3	-	-	-	-	8706	1083	6906	8.24	8219	1047	6166	7.36	7767	1013	5468	6.53	7351	980	4813	5.74	6970	950	4200	5.01
1.5	-	-	-	-	8314	1083	6569	7.84	7827	1047	5828	6.96	7375	1013	5130	6.12	6958	980	4475	5.34	6578	950	3863	4.61
1.7	8443	1120	7018	8.38	7920	1083	6234	7.44	7433	1047	5494	6.56	6981	1013	4796	5.72	6564	980	4141	4.94	6184	950	3528	4.21
1.9	8052	1120	6686	7.98	7529	1083	5903	7.05	7041	1047	5162	6.16	6589	1013	4464	5.33	6173	980	3809	4.55	-	-	-	-
2.1	7668	1120	6359	7.59	7145	1082	5576	6.65	6657	1047	4835	5.77	6206	1013	4137	4.94	-	-	-	-	-	-	-	-
2.3	7296	1120	6037	7.21	6773	1082	5254	6.27	6285	1047	4513	5.39	-	-	-	-	-	-	-	-	-	-	-	-
2.5	6940	1120	5721	6.83	6417	1082	4937	5.89	5929	1047	4196	5.01	-	-	-	-	-	-	-	-	-	-	-	-
2.7	6605	1120	5410	6.46	6081	1082	4627	5.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.9	6294	1120	5108	6.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.1	6014	1120	4813	5.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Blower performance includes two-inch throwaway filters and maximum number of heat tubes available for each tonnage.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "1 Turn Open" is fully closed. DO NOT close the pulley below one turn open.
4. W = Watts



ZJ300 (25 Ton) Standard Drive Gas Heat Bottom Duct Blower Performance

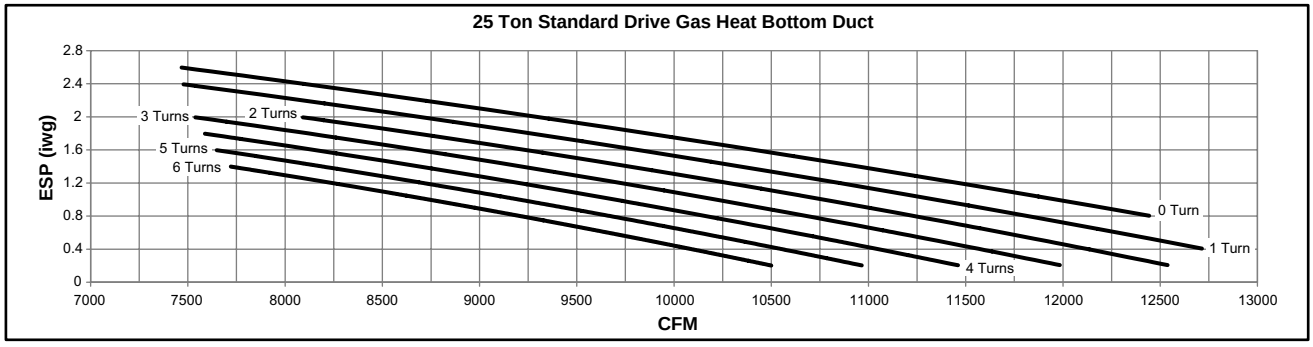
25 Ton Standard Drive Gas Heat Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]																			
	0 Turns				1 Turn				2 Turns				3 Turns				4 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.2	-	-	-	-	-	-	-	-	12538	1101	11592	14.15	11984	1070	10591	12.92	11460	1038	9646	11.77
0.4	-	-	-	-	12714	1133	12215	14.91	12131	1102	11159	13.62	11578	1070	10158	12.40	11054	1038	9212	11.24
0.6	-	-	-	-	12284	1134	11751	14.34	11701	1102	10695	13.05	11147	1070	9694	11.83	10623	1038	8749	10.68
0.8	12443	1165	12369	15.09	11831	1134	11258	13.74	11248	1102	10202	12.45	10694	1070	9201	11.23	10170	1038	8255	10.07
1	11968	1165	11846	14.46	11355	1134	10735	13.10	10772	1102	9678	11.81	10219	1070	8678	10.59	9695	1038	7732	9.44
1.2	11471	1165	11292	13.78	10858	1134	10181	12.42	10275	1102	9125	11.14	9722	1070	8124	9.91	9198	1038	7179	8.76
1.4	10954	1165	10709	13.07	10341	1134	9598	11.71	9758	1102	8542	10.42	9204	1070	7541	9.20	8680	1038	6595	8.05
1.6	10417	1165	10095	12.32	9804	1134	8984	10.96	9221	1102	7928	9.67	8668	1070	6927	8.45	8143	1038	5981	7.30
1.8	9861	1165	9451	11.53	9248	1133	8340	10.18	8665	1102	7284	8.89	8112	1070	6283	7.67	7588	1038	5337	6.51
2	9287	1165	8777	10.71	8675	1133	7665	9.35	8092	1102	6609	8.07	7538	1070	5608	6.84	-	-	-	-
2.2	8697	1165	8072	9.85	8084	1134	6960	8.49	-	-	-	-	-	-	-	-	-	-	-	-
2.4	8090	1165	7336	8.95	7477	1134	6225	7.60	-	-	-	-	-	-	-	-	-	-	-	-
2.6	7467	1166	6570	8.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

25 Ton Standard Drive Gas Heat Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]							
	5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.2	10966	1006	8755	10.68	10500	974	7920	9.66
0.4	10559	1006	8322	10.15	10094	974	7486	9.14
0.6	10129	1006	7858	9.59	9664	975	7023	8.57
0.8	9675	1007	7365	8.99	9210	975	6529	7.97
1	9200	1007	6841	8.35	8735	975	6006	7.33
1.2	8703	1007	6288	7.67	8238	975	5453	6.65
1.4	8186	1006	5704	6.96	7721	975	4869	5.94
1.6	7649	1006	5091	6.21	-	-	-	-
1.8	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-
2.2	-	-	-	-	-	-	-	-
2.4	-	-	-	-	-	-	-	-
2.6	-	-	-	-	-	-	-	-

1. Blower performance includes two-inch throwaway filters and maximum number of heat tubes available for each tonnage.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "0 Turns Open" is fully closed.
4. W = Watts



ZJ300 (25 Ton) Hi-Static Drive Gas Heat Bottom Duct Blower Performance

25 Ton Standard Drive Gas Heat Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]																			
	0 Turns				1 Turn				2 Turns				3 Turns				4 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12606	1217	13475	16.44
1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12141	1217	12901	15.74
1.5	-	-	-	-	-	-	-	-	-	-	-	-	12472	1254	13836	16.88	11659	1216	12304	15.02
1.7	-	-	-	-	-	-	-	-	-	-	-	-	11973	1254	13214	16.12	11160	1216	11682	14.26
1.9	-	-	-	-	-	-	-	-	-	-	-	-	11455	1254	12562	15.33	10642	1216	11031	13.46
2.1	-	-	-	-	-	-	-	-	-	-	-	-	10917	1254	11878	14.50	10104	1216	10347	12.63
2.3	-	-	-	-	-	-	-	-	11229	1291	12788	15.60	10356	1254	11158	13.62	9543	1216	9626	11.75
2.5	-	-	-	-	-	-	-	-	10645	1291	12027	14.68	9772	1254	10398	12.69	8959	1216	8866	10.82
2.7	-	-	-	-	10968	1329	12952	15.81	10035	1291	11224	13.70	9162	1254	9594	11.71	8349	1216	8062	9.84
2.9	11325	1365	13927	17.00	10332	1329	12101	14.77	9399	1291	10373	12.66	8526	1254	8743	10.67	7713	1216	7211	8.80
3.1	10660	1365	13026	15.90	9667	1329	11199	13.67	8734	1291	9471	11.56	7861	1254	7841	9.57	-	-	-	-
3.3	9965	1365	12070	14.73	8972	1329	10244	12.50	8039	1291	8515	10.39	-	-	-	-	-	-	-	-
3.5	9239	1365	11057	13.49	8246	1329	9230	11.26	-	-	-	-	-	-	-	-	-	-	-	-
3.7	8480	1366	9982	12.18	7486	1329	8155	9.95	-	-	-	-	-	-	-	-	-	-	-	-
3.9	7686	1366	8842	10.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

25 Ton Standard Drive Gas Heat Bottom Duct Blower Performance[1]

ESP[2]	Turns Open[3]							
	5 Turns				6 Turns			
	CFM	RPM	W[4]	BHP	CFM	RPM	W[4]	BHP
0.5	-	-	-	-	12478	1140	12334	15.05
0.7	-	-	-	-	12050	1140	11805	14.41
0.9	12305	1179	12598	15.37	11612	1140	11264	13.74
1.1	11854	1179	12042	14.70	11161	1140	10708	13.07
1.3	11388	1179	11468	13.99	10695	1140	10133	12.37
1.5	10907	1179	10871	13.27	10214	1140	9537	11.64
1.7	10408	1179	10249	12.51	9715	1140	8914	10.88
1.9	9890	1179	9598	11.71	9197	1140	8263	10.08
2.1	9351	1179	8914	10.88	8659	1140	7579	9.25
2.3	8791	1179	8193	10.00	8098	1140	6859	8.37
2.5	8206	1179	7433	9.07	-	-	-	-
2.7	7596	1179	6629	8.09	-	-	-	-
2.9	-	-	-	-	-	-	-	-
3.1	-	-	-	-	-	-	-	-
3.3	-	-	-	-	-	-	-	-
3.5	-	-	-	-	-	-	-	-
3.7	-	-	-	-	-	-	-	-
3.9	-	-	-	-	-	-	-	-

1. Blower performance includes two-inch throwaway filters and maximum number of heat tubes available for each tonnage.
2. ESP (External Static Pressure) given is that available for the supply and return air duct system. All internal resistances have been deducted from the total static pressure of the blower.
3. "Turns Open" refers to the setting of the variable pitch motor sheave, where "0 Turns Open" is fully closed.
4. W = Watts

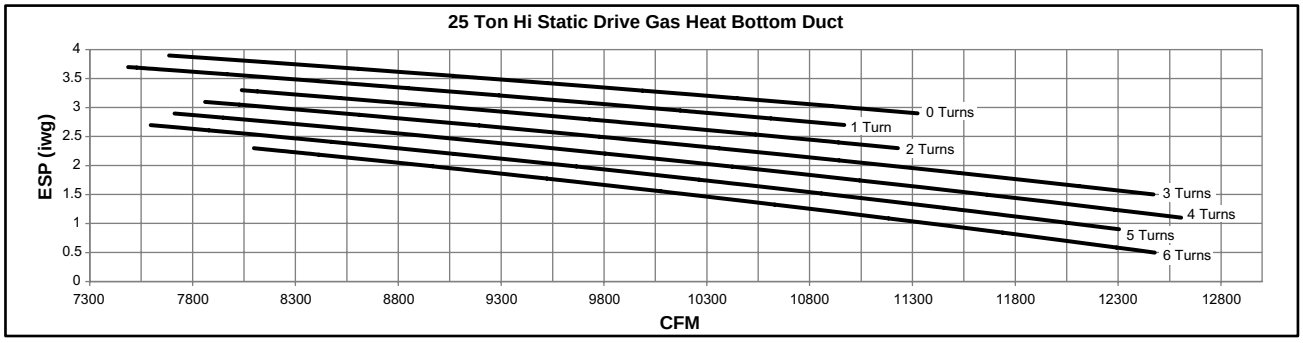


Table 16: Indoor Blower Specifications

Size (Tons)	Motor					Motor Sheave			Blower Sheave			Belt
	HP	RPM	Eff.	SF	Frame	Datum Dia. (in.)	Bore (in.)	Model	Datum Dia. (in.)	Bore (in.)	Model	
180	5	1725	0.83	1.15	184T	4.3 - 5.3	1-1/8	1VP56	8.4	1	BK90	BX81
(15)	5	1725	0.83	1.15	184T	4.3 - 5.3	1-1/8	1VP56	7.4	1	BK80	BX78
210	7.5	1725	0.89	1.15	213T	5.5 - 6.5	1-3/8	1VP68	11.4	1-3/16	BK120	BX83
(17.5)	7.5	1725	0.89	1.15	213T	5.5 - 6.5	1-3/8	1VP68	10.4	1-3/16	BK120	BX81
240	7.5	1725	0.89	1.15	213T	5.5 - 6.5	1-3/8	1VP68	11.4	1-3/16	BK120	BX83
(20)	7.5	1725	0.89	1.15	213T	5.5 - 6.5	1-3/8	1VP68	10.4	1-3/16	BK120	BX81
300	15	1725	0.91	1.15	254T	6.2 - 7.4	1-5/8	1VP75X	11.1	1-7/16	1B5V110	5VX860
(25)	15	1725	0.91	1.15	254T	6.2 - 7.4	1-5/8	1VP75X	9.5	1-7/16	1B5V94	5VX860

Table 17: Power Exhaust Specifications

Voltage	Motor			Motor			CFM @ 0.1 ESP
	HP	RPM[1]	QTY	LRA	FLA	MCA	
208/230-1-60	3/4	1075	1	7.7	5.0	6.25	5250
460-1-60	3/4	1075	1	4.1	2.2	2.75	5250
575-1-60	3/4	1050	1	2.84	1.5	1.875	5250

1. Motors are multi-tapped and factory wired for high speed.

Air Balance

Start the supply air blower motor. Adjust the resistances in both the supply and the return air duct systems to balance the air distribution throughout the conditioned space. The job specifications may require that this balancing be done by someone other than the equipment installer.

To check the supply air CFM after the initial balancing has been completed:

1. Remove the two 5/16” dot plugs from the blower motor and the filter access panels shown in the Unit Dimensions and Rear View Clearances Figure 6.
2. Insert at least 8" of 1/4 inch tubing into each of these holes for sufficient penetration into the air flow on both sides of the indoor coil.

NOTE: The tubes must be inserted and held in a position perpendicular to the air flow so that velocity pressure will not affect the static pressure readings.

3. Using an inclined manometer, determine the pressure drop across a dry evaporator coil. Since the moisture on an evaporator coil may vary greatly, measuring the pressure drop across a wet coil under field conditions would be inaccurate. To assure a dry coil, the compressors should be deactivated while the test is being run.

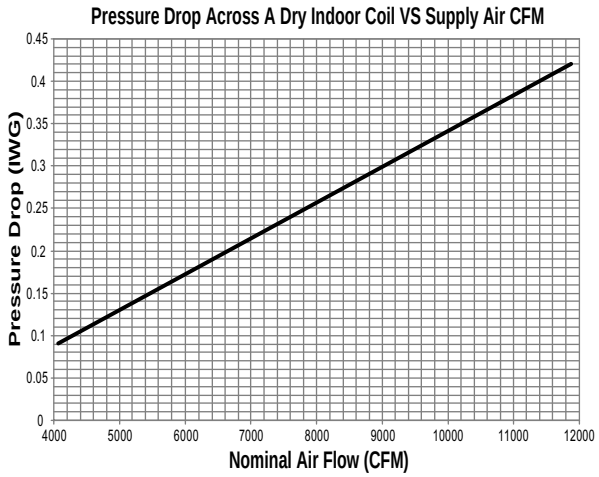


Figure 20: Pressure Drop Across A Dry Indoor Coil Vs. Supply Air CFM For All Unit Tonnages

4. Knowing the pressure drop across a dry coil, the actual CFM through the unit can be determined from the curve in Pressure Drop vs. Supply Air CFM Figure 20.

⚠WARNING

Failure to properly adjust the total system air quantity can result in extensive blower damage.

After readings have been obtained, remove the tubes and reinstall the two 5/16” dot plugs that were removed in Step 1.

NOTE: De-energize the compressors before taking any test measurements to assure a dry indoor coil.

Supply Air Drive Adjustment

The RPM of the supply air blower will depend on the required CFM, the unit accessories or options and the static resistances of both the supply and the return air duct systems. With this information, the RPM for the supply air blower and the motor pulley adjustment (turns open) can be determined from the Blower Performance Data Tables.

High speed drive accessories (containing a smaller blower pulley and a shorter belt) are available for applications requiring the supply air blower to produce higher CFM's and/or higher static pressures. Use Model 1LD0460 for 15 ton units, Model 1LD0417 for 17.5 and 20 ton units, and Model 1LD0435 for 25 ton units. Refer to the Blower Motor and Drive Data Table 16.

Note the following:

1. The supply air CFM must be within the limitations shown in the Blower Performance Tables 14 and 15.
2. Pulleys can be adjusted in half turn increments.

Table 18: Additional Static Resistance

Size (Tons)	CFM	Economizer[1 2]	Electric Heat kW[1]			
			18	36	54	72
180 (15)	4500	0.10	0.10	0.10	0.20	0.20
	6000	0.10	0.10	0.20	0.30	0.40
	7200	0.10	0.10	0.30	0.40	0.60
210 (17.5)	6000	0.10	0.10	0.10	0.20	0.20
	7500	0.10	0.10	0.20	0.30	0.40
	9000	0.10	0.10	0.30	0.40	0.60
240 (20)	6000	0.10	0.10	0.10	0.20	0.20
	8000	0.10	0.10	0.20	0.30	0.40
	9400	0.10	0.10	0.30	0.40	0.60
300 (25)	7500	0.06	0.31	0.38	0.62	0.68
	10000	0.11	0.56	0.68	1.10	1.21
	12500	0.18	0.87	1.07	1.72	1.90

1. Deduct these values from the available external static pressure shown in the respective Blower Performance Tables.
2. The pressure drop through the economizer is greater for 100% outdoor air than for 100% return air. If the resistance of the return air duct is less than 0.25 IWG, the unit will deliver less CFM during full economizer operation.

Operation

Cooling Sequence Of Operation

For ZJ units, the thermostat makes a circuit between “R” and “Y1” for the first stage of cooling.

The call is passed to the **Unit Control Board (UCB),** which then determines whether the requested operation is available and, if so, which components to energize.

For gas heating, the UCB monitors the "W1" call but does not handle the operation of the gas furnace. An ignition control board controls the gas heater operation. For electric heat units, the UCB passes the call to the electric heater. In both cases, when the "W1" call is sensed, the indoor air blower is energized following a specified heating delay.

If at any time a call for both heating and cooling are present, the heating operation will be performed. If operating, the cooling system is halted as with a completion of a call for cooling. Heating always takes priority.

Continuous Blower

By setting the room thermostat fan switch to "ON," the supply air blower will operate continuously.

Intermittent Blower

With the room thermostat fan switch set to "AUTO" and the system switch set to either the "AUTO" or "HEAT" settings, the blower is energized whenever a cooling or heating operation is requested. The blower is energized after any specified delay associated with the operation.

When energized, the indoor blower has a minimum run time of 30 seconds. Additionally, the indoor blower has a delay of 10 seconds between operations.

No Outdoor Air Options

When the thermostat calls for the first stage of cooling, the low-voltage control circuit from “R” to “Y1” and “G” is completed. The UCB energizes the economizer (if installed and free cooling is available) or the first available compressor* and the condenser fans. For first stage cooling, compressor #1 is energized. If compressor #1 is unavailable, compressor #2 is energized. After completing the specified fan on delay for cooling, the UCB will energize the blower motor.

When the thermostat calls for the second stage of cooling, the low-voltage control circuit from “R” to “Y2” is completed. Compressor #2 is energized, provided it has not been locked out, and condenser fan motor #1, and condenser fan motor #2 remain energized. (If the ambient temperature is above 60ºF.)

If there is an initial call for more than one stage of cooling, the UCB will delay energizing compressors #2, #3 & #4 by 30 seconds each, depending on how many stages are called for, in order to avoid a power in-rush.

Once the thermostat has been satisfied, it will de-energize Y1, Y2, Y3 and Y4. If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed. Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling.

To be available, a compressor must not be locked-out due to a high or low-pressure switch or freezestat trip and the **Anti-Short Cycle Delay (ASCD)** must have elapsed.

These units utilize a lead-lag feature that results in an equal amount of run hours on all compressors, thereby extending the life of the compressors. This feature works as follows: If the thermostat requires for more than one stage of cooling, the currently off compressor with the least number of run hours will be the next to be energized. When the thermostat requires fewer stages of cooling, the currently running compressor with the most run hours will be the first to be de-energized.

Economizer With Single Enthalpy Sensor

When the room thermostat calls for “first-stage” cooling, the low voltage control circuit from “R” to “G” and “Y1” is completed. The UCB energizes the blower motor (if the fan switch on the room thermostat is set in the “AUTO” position) and drives the economizer dampers from fully closed to their minimum position. If the enthalpy of the outdoor air is below the set point of the enthalpy controller (previously determined), “Y1” energizes the economizer. The dampers will modulate to maintain a constant supply air temperature as monitored by the discharge air sensor. If the outdoor air enthalpy is above the set point, “Y1” energizes compressor #1.

When the thermostat calls for “second-stage” cooling, the low voltage control circuit from “R” to “Y2” is completed. The UCB energizes the first available compressor. If the enthalpy of the outdoor air is below the set point of the enthalpy controller (i.e. first stage has energized the economizer), “Y2” will energize compressor #1. If the outdoor air is above the set point, “Y2” will energize compressor #2. If Y2 brings on compressor #1 and this condition remains for more than 20 minutes, then compressor #2 will be energized until the thermostat is satisfied.

Once the thermostat has been satisfied, it will de-energize “Y1” and “Y2”. If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed. Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling, and the economizer damper goes to the closed position. If the unit is in continues fan operation, the economizer damper goes to the minimum position.

Economizer With Dual Enthalpy Sensors

The operation with the dual enthalpy sensors is identical to the single sensor except that a second enthalpy sensor is mounted in the return air. This return air sensor allows the economizer to choose between outdoor air and return air, whichever has the lowest enthalpy value, to provide maximum operating efficiency.

Economizer With Power Exhaust

A unit equipped with an economizer (single or dual enthalpy) and a power exhaust operates as specified above with one addition. The power exhaust motor is energized 45 seconds after the actuator position exceeds the exhaust fan set point on the economizer control. When the power exhaust is operating, the second stage of mechanical cooling will not operate. As always, the "R" to "G" connection provides minimum position but does not provide power exhaust operation.

Motorized Outdoor Air Dampers

This system operation is the same as the units with no outdoor air options with one exception. When the “R” to “G” circuit is complete, the motorized damper drives open to a position set by the thumbwheel on the damper motor. When the “R” to “G” circuit is opened, the damper spring returns fully closed.

Cooling Operation Errors

Each cooling system is monitored for operation outside of the intended parameters. Errors are handled as described below. All system errors override minimum run times for compressors.

High-Pressure Limit Switch

During cooling operation, if a high-pressure limit switch opens, the UCB will de-energize the associated compressor, initiate the ASCD (Anti-short cycle delay), and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a high-pressure switch open three times within two hours of operation, the UCB will lock-out the associated compressor and flash a code (see Table 24). If the other compressor is inactive, the condenser fans will be de-energized.

Low-Pressure Limit Switch

The low-pressure limit switch is not monitored during the initial 30 seconds of a cooling system's operation. For the following 30 seconds, the UCB will monitor the low-pressure switch to ensure it closes. If the low-pressure switch fails to close after the 30-second monitoring phase, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans. If the LPS is still open after the ASCD, the compressor will not be energized for 30 seconds. The second and third times that the UCB sees an open LPS will count towards the three occurrences that will cause a UCB lock-out.

Once the low-pressure switch has been proven (closed during the 30-second monitor period described above), the UCB will monitor the low-pressure limit switch for any openings. If the low-pressure switch opens for greater than 5 seconds, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans.

If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a low-pressure switch open three times within one hour of operation, the UCB will lock-out the associated compressor and flash a code (Table 24). If the other compressor is inactive, the condenser fans will be de-energized.

Freezestat

During cooling operation, if a freezestat opens, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a freezestat open three times within two hours of operation, the UCB will lock-out the associated compressor and flash a code (Table 24). If the other compressor is inactive, the condenser fans will be de-energized.

Low Ambient Cooling

To determine when to operate in low ambient mode, the UCB has a pair of terminals connected to a temperature-activated switch set at 45ºF. When the low ambient switch is closed and the thermostat is calling for cooling, the UCB will operate in the low ambient mode.

Low ambient mode operates the compressors in this manner: 10 minutes on, 5 minutes off. The indoor blower is operated throughout the cycle. The 5-minute off period is necessary to defrost the indoor coil.

Low ambient mode always begins with compressor operation. Compressor minimum run time may extend the minutes of compressor operation. The defrost cycle will begin immediately following the elapse of the minimum run time.

When operating in low ambient mode, the UCB will not lockout the compressors due to a freezestat trip. However, a freezestat trip will de-energize the associated compressor. If the call for cooling is still present at the end of the ASCD and the freezestat has closed, the unit will resume operation.

Safety Controls

The unit control board monitors the following inputs for each cooling system:

1. A suction line freezestat to protect against low evaporator temperatures due to a low airflow or a low return air temperature, (opens at 26 ± 5 °F and resets at 38 ± 5°F).
2. A high-pressure switch to protect against excessive discharge pressures due to a blocked condenser coil or a condenser motor failure, (opens at 625 ± 25 psig and resets 500 ± 25 psig).
3. A low-pressure switch to protect against loss of refrigerant charge, (opens at 50 ± 5 psig and resets at 71 ± 5 psig).

The above pressure switches are hard-soldered to the unit. The refrigeration systems are independently monitored and controlled. On any fault, only the associated system will be affected by any safety/preventive action. The other refrigerant system will continue in operation unless it is affected by the fault as well.

The unit control board monitors the temperature limit switch of electric heat units and the temperature limit switch and the gas valve of gas furnace units.

Compressor Protection

In addition to the external pressure switches, the compressors also have inherent (internal) protection. If there is an abnormal temperature rise in a compressor, the protector will open to shut down the compressor. The UCB incorporates features to minimize compressor wear and damage. An **Anti-Short Cycle Delay (ASCD)** is utilized to prevent operation of a compressor too soon after its previous run. Additionally, a minimum run time is imposed any time a compressor is energized.

The ASCD is initiated on unit start-up and on any compressor reset or lock-out.

Flash Codes

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 24.

Reset

Remove the call for cooling, by raising thermostat setting higher than the conditioned space temperature. This resets any pressure or freezestat flash codes.

Electric Heating Sequence Of Operations

The following sequence describes the operation of the electric heat section.

Single-stage heating: (applies only to 18 KW heater, all other heaters MUST use a two-stage thermostat)

a. Upon a call for heat by the thermostat, the heater contactor (6M) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

b The thermostat will cycle the electric heat to satisfy the heating requirements of the conditioned space.

Two-stage heating: (applies to all heaters except 18 KW)

a. Upon a call for first-stage heat by the thermostat, the heater contactor (6M) (6M & 7M on 72 KW, 240V) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

   If the second stage of heat is required, heater contactor (7M) will be energized. Note that on the 54 KW, 240V heater, heater contactors (7M & 8M) will be energized and on the 72 KW, 240V heater, heater contactors (8M & 9M) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

b The thermostat will cycle the electric heat to satisfy the heating requirements of the conditioned space.

NOTE: All 240 & 480V heaters are provided with manual reset backup protection limits. These will de-energize the heaters should the primary limit fail to open or the contactors fail to open in a failure mode.

Electric Heat Operation Errors

Temperature Limit

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized.

This limit is monitored regardless of unit operation status, i.e. the limit is monitored at all times.

If the temperature limit opens three times within one hour, it will lock-on the indoor blower motor and a flash code is initiated (See Table 24).

Safety Controls

The UCB monitors the temperature limit switch of electric heat units.

The control circuit includes the following safety controls:

Temperature Limit Switch (TLs)

1. Temperature Limit Switch (TLS 1, 2).

   This control is located inside the heater compartment and is set to open at the temperature indicated in the Limit Control Setting Table 19. It resets automatically. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the heater and energizing the blower.

2. Temperature Limit Switch (TLS 3, 4, 5 and 6).

   This control is located inside the heater compartment and is set to open at the temperature indicated in the Limit Control Setting Table 19. It is a manual reset limit. These limit switches will de-energize the heaters should the primary limit fail to open or the contactors fail to open in a failure mode.

Table 19: Limit Control Setting

Unit (Tons)	Voltage	Heater Kw	Temperature, Limit Switch 1, 2 Opens, °F	Temperature, Limit Switch 3, 4, 5, 6 Opens, °F
15	240	18	120	170
		36	120	170
		54	120	170
		72	120	170
17.5, 20 and 25	240	18	140	200
		36	140	200
		54	140	200
		72	140	200
15, 17.5, 20 and 25	460	18	120	170
		36	120	170
		54	120	170
		72	120	170
15, 17.5, 20 and 25	600	18	120	-
		36	120	-
		54	120	-
		72	120	-

Flash Codes

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 24.

Reset

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature.This resets any flash codes.

Electric Heat Anticipator Setpoints

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter “ON” cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 20 for the required electric heat anticipator setting.

Table 20: Electric Heat Anticipator Setpoint

Heater Kw	Voltage	Setting, Amps	
		Th1	Th2
18	208/230-3-60	0.29	-
36		0.29	0.29
54		0.29	0.58
72		0.29	0.58
18	460-3-60	0.29	-
36		0.29	0.29
54		0.29	0.29
72		0.29	0.29
18	575-3-60	0.29	-
36		0.29	0.29
54		0.29	0.29
72		0.29	0.29

Gas Heating Sequence Of Operations

The following sequence describes the operation of the gas heat section.

When the thermostat calls for the first stage of heating, the low-voltage control circuit from “R” to “W1” and “G” is completed, thru the UCB. The heat relay “RW1” is energized. The “RW1-2” contacts close energizing the draft motor control. The draft motor control contacts close and start the draft motor. As the speed of the draft motor reaches approximately 2500 RPM, the centrifugal switch contact, located on the end of the draft motor shaft, closes to power the first stage ignition module “IC1”, thru the “RW1-1” contacts.

Ignition module “IC1” will immediately start the first stage igniter sparking and will open the redundant valve located inside the first stage main gas valve “GV1” to allow a flow of gas to only the first stage carryover tube. Only after the pilot flame has been ignited and the presence of pilot flame detected at the “IC1” by a signal sent back through the flame sensor is sparking terminated and the first stage main gas valve opened.

Gas flows into each of the main burners and is ignited from the carryover tube flame.

After completing the specified fan on delay for heating, the UCB will energize the blower motor.

If “IC1” fails to detect a pilot flame, it will continue to try for a maximum of 85 seconds to ignite the pilot tube. If the pilot flame is not detected, then “IC1” will lock out first stage furnace operation for five minutes or until 24V power is removed from the module either at the unit or by resetting the room thermostat.

When the thermostat calls for the second stage of heating, the low-voltage control circuit from “R” to “W2” is completed, thru the UCB. Heat relay “RW2” is energized. The “RW2-1” contact is closed energizing the second stage ignition module “IC2”. “IC2” will immediately start the second stage igniter sparking and will open the redundant valve located inside the second stage main gas valve “GV2” to allow a flow of gas to the second stage carryover tube. Only after the pilot flame has been ignited and the presence of pilot flame detected at “IC2” by a signal sent back through the flame sensor is sparking terminated and the main gas valve opened.

Gas flows into each of the second stage main burners and is ignited from the carryover tube flame.

If “IC2” fails to detect a pilot flame, it will continue to try for a maximum of 85 seconds to ignite the pilot tube. If the pilot flame is not detected, then “IC2” will lock out first stage furnace operation for five minutes or until 24V power is removed from the module either at the unit or by resetting the room thermostat.

NOTE: That the second stage furnace can operate even if first stage has locked out.

When the thermostat satisfies de-energizing the “RW2”and “RW1”, thus opening all gas valves. The blower motor will continue to run after the furnace is shut down until the specified fan off delay for heating has been satisfied. The UCB will de-energize the blower motor.

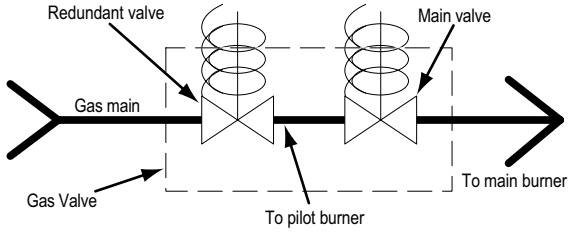


Figure 21: Gas Valve Piping

When the thermostat calls for the first stage of heating, the low-voltage control circuit from “R” to “W1” is completed. A call for heat passes through the UCB to the ignition control board (ICB). The UCB monitors the “W1” call and acts upon any call for heat. Once voltage has been sensed at “W1”, the UCB will initiate the fan on delay for heating, energizing the indoor blower after the specified delay has elapsed.

When the thermostat has been satisfied, heating calls are ceased. The GV is immediately de-energized. The blower is de-energized after the fan off delay for heating has elapsed. The draft motor performs a 25-second post purge.

Gas Heating Operation Errors

Temperature Limit

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized. When the UCB again senses 24 volts from the temperature limit, the draft motor will perform a 25-second post-purge and the indoor blower will be de-energized following the elapse of the fan off delay for heating.

This limit is monitored regardless of unit operation status, i.e. this limit is monitored at all times.

If the temperature limit opens three times within one hour, it will lock-on the indoor blower motor and flash code is initiated (See Table 24).

Gas Valve

The UCB continuously monitors the GV. Any time the UCB senses voltage at the GV without a call for heat for a continuous five-minute period, the UCB will lock-on the indoor blower and a flash code is initiated (Table 24). When voltage is no longer sensed at the GV, the UCB will de-energize the indoor blower following the elapse of the fan off delay for heating.

If voltage has been sensed at the GV for at least 15 seconds during the fan on delay for heating and GV voltage or “W1” is lost, the indoor blower is forced on for the length of the fan off delay for heating.

Safety Controls

The UCB monitors the temperature limit switch of gas heat units.

The control circuit includes the following safety controls:

Limit Switch (LS)

This control is located inside the gas heat compartment and is set to open at the temperature indicated in the Gas Heat Limit Control Settings Table 21. It resets automatically. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the heater and energizing the blower.

Centrifugal Switch (CS)

If the draft motor should fail, the centrifugal switch attached to the shaft of the motor prevents the ignition controls and gas valves from being energized.

Redundant Gas Valve

There are two separate gas valves in the furnace. Each valve contains a main and a redundant valve. The redundant valves are located upstream of the main gas valves. Should either or both of the main gas valves fail in the open position the redundant valves serve as back-ups and shut off the flow of gas.

Flame Sensor Rod / 100% Ignition Control Lock-Out.

The flame rods and controls are located per Proper Flame Adjustment Figure 23. If an ignition control fails to detect a signal from the flame sensor indicating the pilot flame is properly ignited, then the main gas valve will not open. It will continue to try and ignite the pilot for a maximum of 85 seconds, then if the pilot flame is not detected, the ignition control will lock out furnace operation until 24V power is removed from the module either at the unit or by resetting the room thermostat.

Rollout Switch

This switch is located above the main burners in the control compartment, which in the event of a sustained main burner rollout shuts off and locks out both ignition controls closing both gas valves. The ignition controls lock out furnace operation until 24V power is removed from the controls either at the unit or by resetting the room thermostat.

Auxiliary Limit Switch (AUX)

This control is located inside the heat exchanger compartment and is set to open at 190°F. It is a manual reset switch. If AUX trips, then the primary limit has not functioned correctly. Replace the primary limit.

Table 21: Gas Heat Limit Control Setting

Units (Tons)	Capacity, MBH		Limit Control Opens, ºF
	Input	Output	
15, 17.5, 20 & 25	300	240	195
15, 17.5, 20 & 25	400	320	195

The ICB monitors the Pressure and Rollout switches of gas heat units.

The control circuit includes the following safety controls:

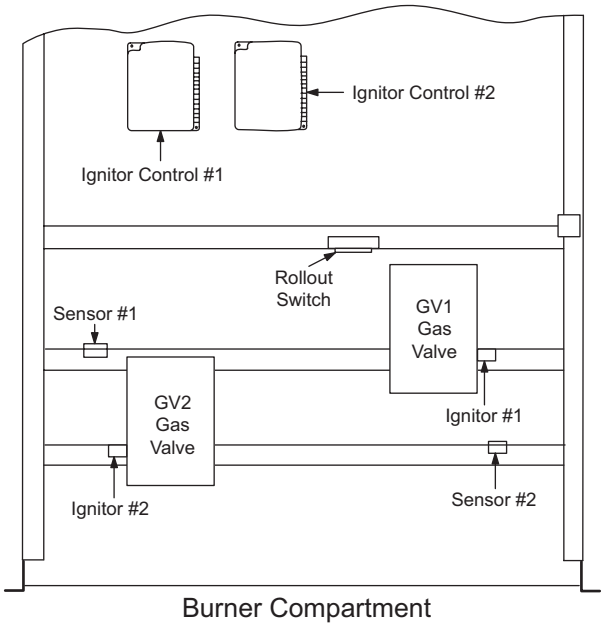


Figure 22: Gas Valve and Controls

Flash Codes

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 24.

Resets

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature. This resets any flash codes.

Gas Heat Anticipator Setpoints

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter “ON cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 22 for the required gas heat anticipator setting.

Table 22: Gas Heat Anticipator Setpoints

Gas Valve	Anticipator Setpoint	
	1st Stage	2nd Stage
Honeywell VR8440	0.30 amp	0.11 amp
White-Rodgers 36C68		

Start-Up (Cooling)

Prestart Check List

After installation has been completed:

1. Check the electrical supply voltage being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Set the room thermostat to the off position.
3. Turn unit electrical power on.
4. Set the room thermostat fan switch to on.
5. Check indoor blower rotation.
   - If blower rotation is in the wrong direction. Refer to Phasing Section in general information section.

   Check blower drive belt tension.
6. Check the unit supply air (CFM).
7. Measure evaporator fan motor's amp draw.
8. Set the room thermostat fan switch to off.
9. Turn unit electrical power off.

Operating Instructions

1. Turn unit electrical power on.
2. Set the room thermostat setting to lower than the room temperature.
3. First stage compressors will energize after the built-in time delay (five minutes).
4. The second stage of the thermostat will energize second stage compressor if needed.

Post Start Check List

1. Verify proper system pressures for both circuits.
2. Measure the temperature drop across the evaporator coil.
3. Measure the system amperage draw across all legs of 3 phase power wires.
4. Measure the condenser fan amperage draw.

Start-Up (Gas Heat)

Pre-Start Check List

Complete the following checks before starting the unit.

1. Check the type of gas being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Make sure that the vent and combustion hoods have been properly installed.

Operating Instructions

⚠ CAUTION

This furnace is equipped with an intermittent pilot and automatic re-ignition system. DO NOT attempt to manually light the pilot.

Lighting The Main Burners

1. Turn “OFF” electric power to unit.
2. Turn room thermostat to lowest setting.
3. Turn gas valve knob or switch to “ON” position (See Figure 25).
4. Turn “ON” electric power to unit.
5. Set room thermostat to desired temperature (If thermostat “set” temperature is above room temperature, pilot burner ignition will occur and, after an interval to prove pilot flame, main burners will ignite).

Post Start Checklist

After the entire control circuit has been energized and the heating section is operating, make the following checks:

1. Check for gas leaks in the unit piping as well as the supply piping.

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

2. Check for correct manifold gas pressures. (See CHECKING GAS INPUT.)
3. Check the supply gas pressure. It must be within the limits shown on the rating nameplate. Supply pressure should be checked with all gas appliances in the building at full fire. At no time should the standby gas pressure exceed 13 in. or the operating pressure drop below 5.0 in for natural gas units. If gas pressure is outside these limits, contact the local gas utility or propane supplier for corrective action.

Shut Down

1. Set the thermostat to the lowest temperature setting.
2. Turn “OFF” all electric power to unit.
3. Open gas heat access panel.
4. Turn gas valve clockwise to “OFF” position (See Figure 25).

Checking Gas Heat Input

1. Turn off all other gas appliances connected to the gas meter.
2. With the furnace turned on, measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter usually has a 1/2 or a 1 cubic foot test dial.
3. Using the number of seconds for each revolution and the size of the test dial increment, find the cubic feet of gas consumed per hour from the Gas Rate - Cubic Feet Per Hour Table 23.

If the actual input is not within 5% of the furnace rating (with allowance being made for the permissible range of the regulator setting), replace the orifice spuds with spuds of the proper size.

NOTE: To find the Btu input, multiply the number of cubic feet of gas consumed per hour by the Btu content of the gas in your particular locality (contact your gas company for this information - it varies widely from city to city.)

Table 23: Gas Rate Cubic Feet Per Hour

Seconds for One Rev.	Size of Test Dial	
	1/2 cu. ft.	1 cu. ft.
4	450	900
6	300	600
8	228	450
10	180	360
12	150	300
14	129	257
16	113	225
18	100	200
20	90	180
22	82	164
24	75	150
26	69	138
28	64	129

EXAMPLE

By actual measurement, it takes 13 seconds for the hand on the 1-cubic foot dial to make a revolution with just a 300,000 Btuh furnace running. Read across to the column in the table above, headed “1 Cubic Foot”, where you will see that 278 cubic feet of gas per hour are consumed by the furnace at that rate. Multiply 278 x 1050 (the Btu rating of the gas obtained from the local gas company). The result is 292,425 Btuh, which is close to the 300,000 Btuh rating of the furnace.

Manifold Gas Pressure Adjustment

Small adjustments to the high-fire gas flow may be made by turning the pressure regulator adjusting screw on the automatic gas valve.

Adjust as follows:

1. Remove the cap on the regulator. It's located next to the push-on electrical terminals.
2. To decrease the gas pressure, turn the adjusting screw counterclockwise.
3. To increase the gas pressure, turn the adjusting screw clockwise.

NOTE: The correct manifold pressure for these furnaces is 3.65 IWG ± 0.3.

Adjustment Of Temperature Rise

The temperature rise (the difference of temperature between the return air and the heated air from the furnace) must lie within the range shown on the CSA rating plate and the data in Table 10.

After the temperature rise has been determined, the CFM can be calculated as follows:

$$\text{CFM} = \text{Btu Input} \cdot \frac{0.8}{(1.08 \cdot \Delta°\text{F})}$$

After about 20 minutes of operation, determine the furnace temperature rise. Take readings of both the return air and the heated air in the ducts (about 6 feet from the furnace) where they will not be affected by radiant heat. Increase the blower CFM to decrease the temperature rise; decrease the blower CFM to increase the rise (See SUPPLY AIR DRIVE ADJUSTMENT).

NOTE: Each gas heat exchanger size has a minimum allowable CFM. Below this CFM, the limit will open.

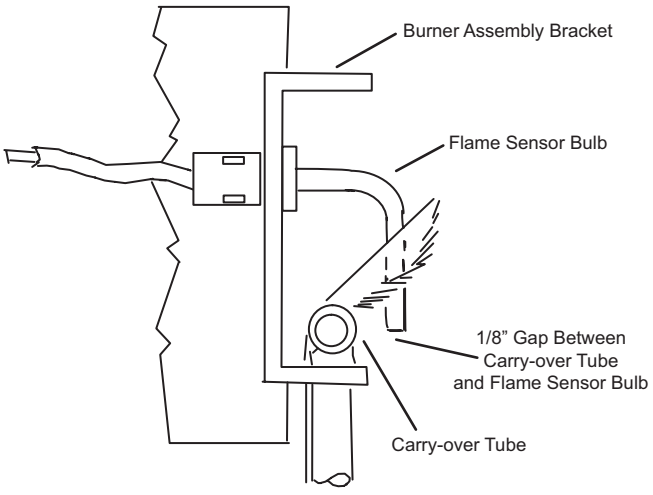


Figure 23: Proper Pilot Flame Adjustment

Pilot Checkout

The pilot flame should envelope the end of the flame sensor. To adjust pilot flame, (1) remove pilot adjustment cover screw, (2) increase or decrease the clearance for air to the desired level, (3) be sure to replace cover screw after adjustment to prevent possible gas leakage.

Put the system into operation and observe through complete cycle to be sure all controls function properly.

Burner Instruction

To check or change burners, pilot or orifices, CLOSE MAIN MANUAL SHUT-OFF VALVE AND SHUT OFF ALL ELECTRIC POWER TO THE UNIT.

1. Remove the screws holding either end of the manifold to the burner supports.
2. Open the union fitting in the gas supply line just upstream of the unit gas valve and downstream from the main manual shut-off valve.
3. Remove the gas piping closure panel.
4. Disconnect wiring to the gas valves and spark ignitors. Remove the manifold-burner gas valve assembly by lifting up and pulling back.

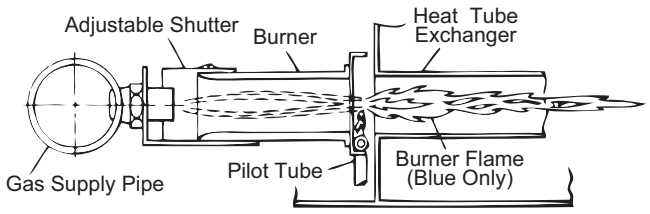


Figure 24: Typical Flame

Burners are now accessible for service.

Reverse the above procedure to replace the assemblies. Make sure that burners are level and seat at the rear of the heat exchanger.

Burner Air Shutter Adjustment

Adjust burner shutters so no yellow flame is observed in the heat exchanger tubes.

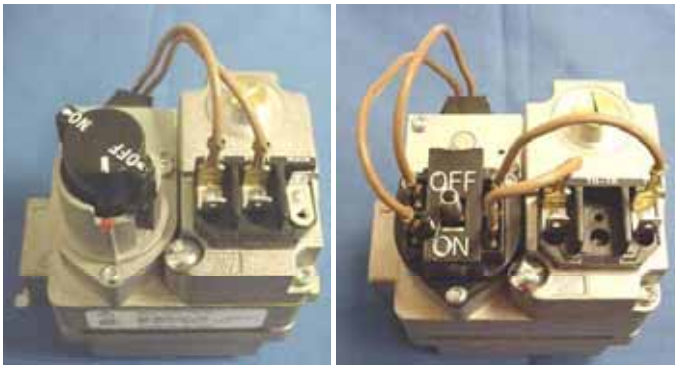


Figure 25: Typical Gas Valve

Charging The Unit

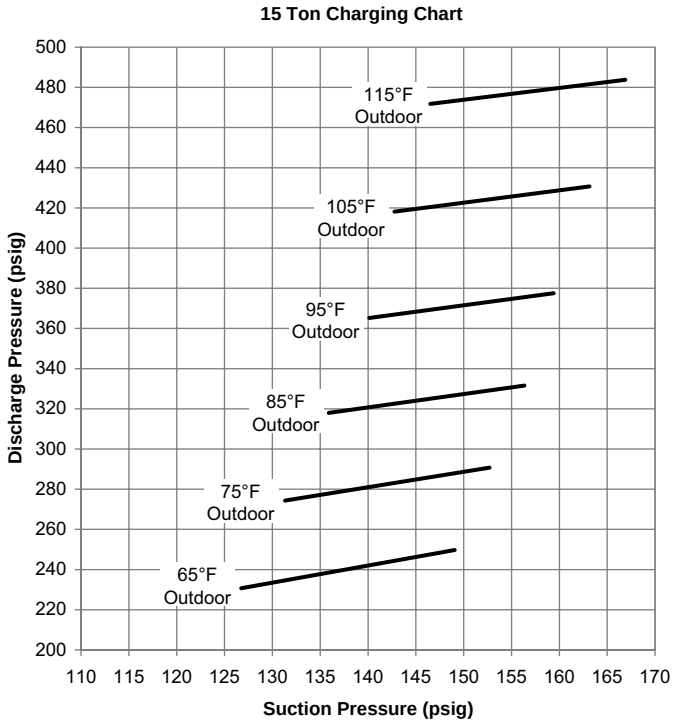


Figure 26: ZJ180 (15 Ton) Charging Chart

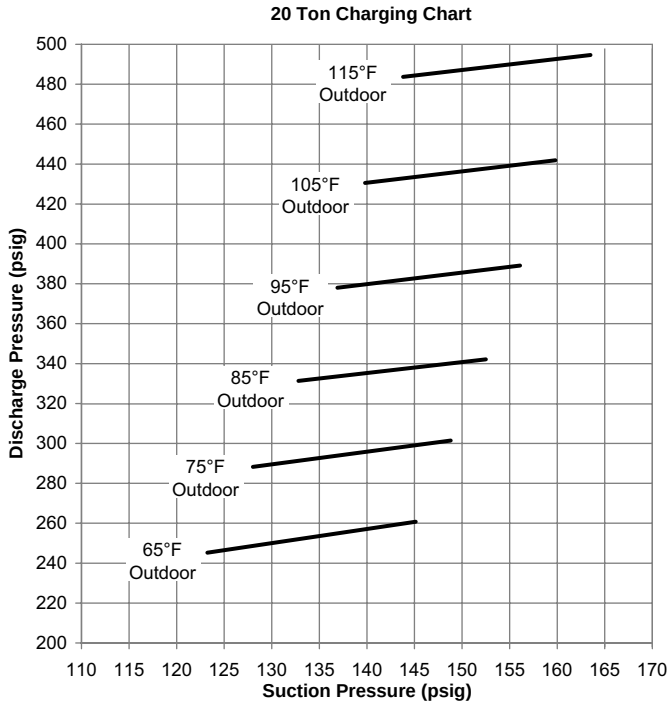


Figure 28: ZJ240 (20 Ton) Charging Chart

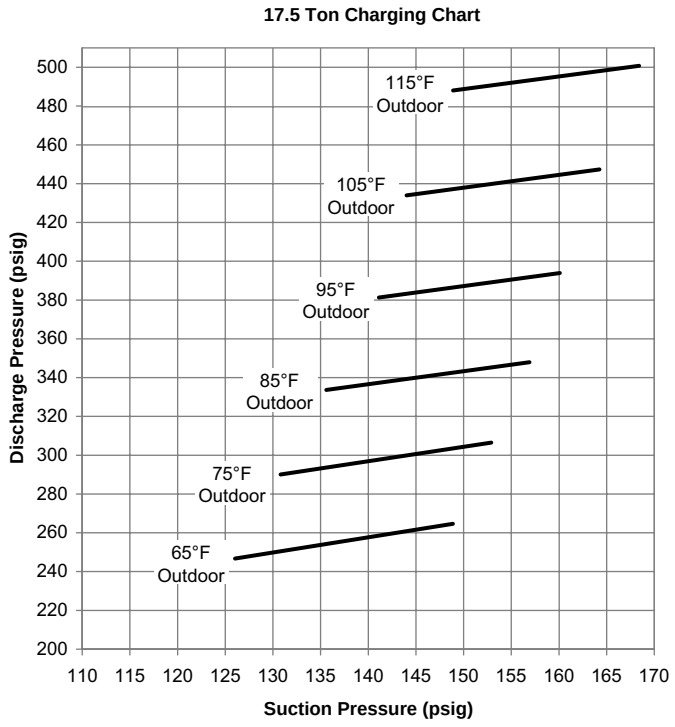


Figure 27: ZJ210 (17.5 Ton) Charging Chart

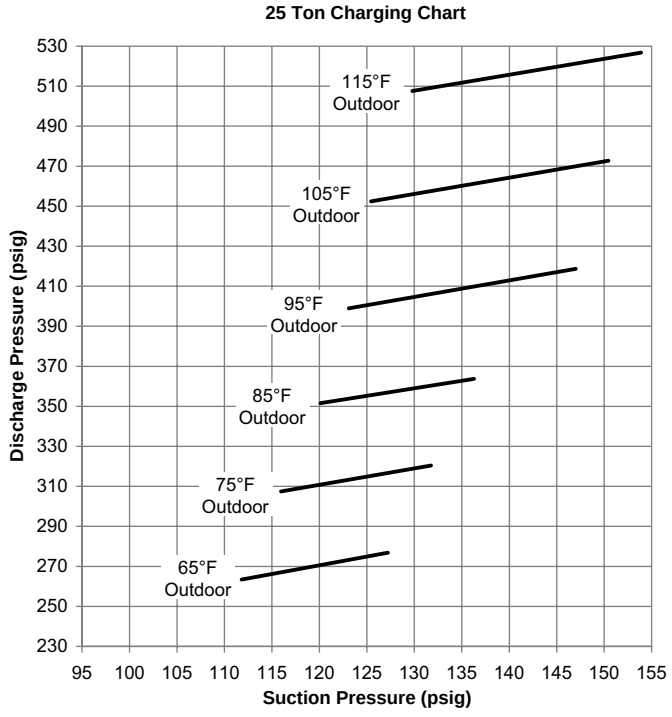


Figure 29: ZJ300 (25 Ton) Charging Chart

Troubleshooting

⚠WARNING

Troubleshooting of components may require opening the electrical control box with the power connected to the unit. **Use extreme care when working with live circuits!** Check the unit nameplate for the correct line voltage and set the voltmeter to the correct range before making any connections with line terminals.

When not necessary, shut off all electric power to the unit prior to any of the following maintenance procedures so as to prevent personal injury.

⚠ CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation which could cause injury to person and/or damage unit components. Verify proper operation after servicing.

Cooling Troubleshooting Guide

On calls for cooling, if the compressors are operating but the supply air blower motor does not energize after a short delay (the room thermostat fan switch is in the “AUTO” position):

1. Turn the thermostat fan switch to the ON position. If the supply air blower motor does not energize, go to Step 2.
2. If the supply air blower motor does not energize when the fan switch is set to ON, check that line voltage is being supplied to the contacts of the M3, contactor, and that the contactor is pulled in. Check for loose wiring between the contactor and the supply air blower motor.
3. If M3 is pulled in and voltage is supplied to M3, lightly touch the supply air blower motor housing. If it is hot, the motor may be off on internal protection. Cancel any thermostat calls and set the fan switch to AUTO. Wait for the internal overload to reset. Test again when cool.
4. If M3 is not pulled in, check for 24 volts at the M3 coil. If 24 volts are present at M3 but M3 is not pulled in, replace the contactor.
5. Failing the above, if there is line voltage supplied at M3, M3 is pulled in, and the supply air blower motor still does not operate, replace the motor.
6. If 24 volts is not present at M3, check that 24 volts is present at the UCB supply air blower motor terminal, “FAN”. If 24 volts is present at the FAN, check for loose wiring between the UCB and M3.
7. If 24 volts is not present at the “FAN” terminal, check for 24 volts from the room thermostat. If 24 volts are not present from the room thermostat, check for the following:
   a. Proper operation of the room thermostat (contact between R and G with the fan switch in the ON position and in the AUTO position during operation calls).
   b. Proper wiring between the room thermostat and the UCB, and
   c. Loose wiring from the room thermostat to the UCB
8. If 24 volts is present at the room thermostat but not at the UCB, check for proper wiring between the thermostat and the UCB, i.e. that the thermostat G terminal is connected to the G terminal of the UCB, and for loose wiring.
9. If the thermostat and UCB are properly wired, replace the UCB.

On calls for cooling, the supply air blower motor is operating but compressor #1 is not (the room thermostat fan switch is in the “AUTO” position):

1. If installed, check the position of the economizer blades. If the blades are open, the economizer is providing free cooling and the compressors will not immediately operate. If both stages of cooling are requested simultaneously and the economizer provides free cooling, following a short delay compressor #1 will be energized unless it is locked out. If compressor #1 is locked out, compressor #2 is energized. Compressor #2 is always energized in place of compressor #1 when compressor #1 is requested but locked out.
2. If no economizer is installed or the economizer is not opening to provide free cooling and compressor #1 does not energize on a call for cooling, check for line voltage at the compressor contactor, M1, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.
3. If M1 is pulled in and voltage is supplied at M1, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.
4. If M1 is not pulled in, check for 24 volts at the M1 coil. If 24 volts are present and M1 is not pulled in, replace the contactor.
5. Failing the above, if voltage is supplied at M1, M1 is pulled in, and the compressor still does not operate, replace the compressor.
6. If 24 volts is not present at M1, check for 24 volts at the UCB terminal, C1. If 24 volts is present, check for loose wiring between C1 and the compressor contactor.
7. If 24 volts is not present at the C1 terminal, check for 24 volts from the room thermostat at the UCB Y1 terminal. If 24 volts is not present from the room thermostat, check for the following:
   a. 24 volts at the thermostat Y1 terminal
   b. Proper wiring between the room thermostat and the UCB, i.e. Y1 to Y1, Y2 to Y2, and
   c. Loose wiring from the room thermostat to the UCB
8. If 24 volts is present at the UCB Y1 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freezestat. Check for 24 volts at the HPS1, LPS1, and FS1 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS1 has opened, there will be a 24-volt potential between the LPS1 terminals.

9. If 24 volts is present at the UCB Y1 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for repeat trips. The UCB should be flashing an alarm code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out, cancel any call for cooling. This will reset any compressor lock outs. If the LPS is still open after the ASCD, the compressor will not be energized for 30 seconds. The second and third times that the UCB sees an open LPS will count towards the three occurrences that will cause a UCB lock-out.

NOTE: While the above step will reset any lockouts, compressor #1 may be held off for the ASCD. See the next step.

10. If 24 volts is present at the UCB Y1 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.
11. If 24 volts is present at the UCB Y1 terminal and the compressor is not out due to a protective switch trip, repeat trip lock out, or ASCD, the economizer terminals of the UCB may be improperly wired. Check for 24 volts at the Y1 "OUT" terminal of the UCB. If 24 volts is present, trace the wiring from Y1 "OUT" for incorrect wiring. If 24 volts is not present at the Y1 "OUT" terminal, the UCB must be replaced.
12. *For units without economizers*: If 24 volts is present at the Y1 OUT terminal, check for 24 volts at the Y1 "ECON" terminal. If 24 volts is not present, check for loose wiring from the Y1 "OUT" terminal to the Mate-N-Lock plug, the jumper in the Mate-N-Lock plug, and in the wiring from the Mate-N-Lock plug to the Y1 "ECON" terminal.
13. *For units with economizers*: If 24 volts is present at the Y1 "OUT" terminal, check for 24 volts at the Y1 "ECON" terminal. If 24 volts is not present, check for loose wiring from the Y1 "OUT" terminal to the Mate-N-Lock plug, a poor connection between the UCB and economizer Mate-N-Lock plugs, loose wiring from the Mate-N-Lock plug to the economizer, back to the Mate-N-Lock plug, and from the Mate-N-Lock plug to the Y1 "ECON" terminal. If nothing is found, the economizer control may have faulted and is failing to return the 24-volt "call" to the Y1 "ECON" terminal even though the economizer is not providing free cooling. To test, disconnect the Mate-N-Locks and jumper between the WHITE and YELLOW wires of the UCB's Mate-N-Lock plug. If compressor #1 energizes, there is a fault in the economizer wiring or the economizer control.
14. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. Local distributors can test the UCB for this programming.

    For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.

    For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.
15. If none of the above corrected the error, test the integrity of the UCB. Disconnect the C1 terminal wire and jumper it to the Y1 terminal. DO NOT jump the Y1 to C1 terminals. If the compressor engages, the UCB has faulted.
16. If none of the above correct the error, replace the UCB.

On calls for the second stage of cooling, the supply air blower motor and compressor #1 are operating but compressor #2 is not (the room thermostat fan switch is in the "AUTO" position):

1. If installed, check the position of the economizer blades. If the blades are open, the economizer is providing free cooling. If the second stage of cooling is requested, following a short delay, compressor #1 will be energized unless it is locked out. Typically, compressor #2 is energized only during free cooling if the call for the second stage of cooling persists for 20 minutes.
2. Compressor #2 will not energize simultaneously with compressor #1 if a call for both stages of cooling is received. The UCB delays compressor #2 by 30 seconds to prevent a power surge. If after the delay compressor #2 does not energize on a second stage call for cooling, check for line voltage at the compressor contactor, M2, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.
3. If M2 is pulled in and voltage is supplied at M2, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.
4. If M2 is not pulled in, check for 24 volts at the M2 coil. If 24 volts is present and M2 is not pulled in, replace the contactor.
5. Failing the above, if voltage is supplied at M2, M2 is pulled in, and the compressor still does not operate, replace the compressor.
6. If 24 volts is not present at M2, check for 24 volts at the UCB terminal, C2. If 24 volts are present, check for loose wiring between C2 and the compressor contactor.
7. If 24 volts is not present at the C2 terminal, check for 24 volts from the room thermostat at the UCB Y2 terminal. If 24 volts is not present from the room thermostat, check for the following:
    a. 24 volts at the thermostat Y2 terminal
    b. Proper wiring between the room thermostat and the UCB, i.e. Y1 to Y1, Y2 to Y2, and
    c. Loose wiring from the room thermostat to the UCB
8. If 24 volts is present at the UCB Y2 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freezestat. Check for 24 volts at the HPS2, LPS2, and FS2 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS2 has opened, there will be 24 volts of potential between the LPS2 terminals.
9. If 24 volts is present at the UCB Y2 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for repeat trips. The UCB

should be flashing a code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out,

remove any call for cooling at the thermostat or by disconnecting the thermostat wiring at the Y1, Y2, Y3 and Y4 on the UCB terminal. This will reset any compressor lock outs, except LPS lockouts these can only be reset by cycling power to UCB.

NOTE: While the above step will reset any lock outs, compressor #1 will be held off for the ASCD, and compressor #2 may be held off for a portion of the ASCD. See the next step.

10. If 24 volts is present at the UCB Y2 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.
11. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. Local distributors can test the UCB for this programming.

    For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.

    For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.
12. If none of the above corrected the error, test the integrity of the UCB. Disconnect the C2 terminal wire and jumper it to the Y2 terminal. DO NOT jump the Y2 to C2 terminals. If the compressor engages, the UCB has faulted.
13. If none of the above correct the error, replace the UCB.

On a call for cooling, the supply air blower motor and compressor #2 are operating but compressor #1 is not (the room thermostat fan switch is in the “AUTO” position):

1. Compressor #2 is energized in place of compressor #1 when compressor #1 is unavailable for cooling calls. Check the UCB for alarms indicating that compressor #1 is locked out. Press and release the ALARMS button if the LED is not flashing an alarm.
2. Check for line voltage at the compressor contactor, M1, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.
3. If M1 is pulled in and voltage is supplied at M1, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.
4. If M1 is not pulled in, check for 24 volts at the M1 coil. If 24 volts is present and M1 is not pulled in, replace the contactor.
5. Failing the above, if voltage is supplied at M1, M1 is pulled in, and the compressor still does not operate, replace the compressor.
6. If 24 volts is not present at M1, check for 24 volts at the UCB terminal, C1. If 24 volts is present, check for loose wiring between C1 and the compressor contactor.
7. If 24 volts is not present at the C1 terminal, check for 24 volts from the room thermostat at the UCB Y1 terminal. If 24 volts are not present at the UCB Y1 terminal, the UCB may have faulted. Check for 24 volts at the Y1 ECON terminal. If 24 volts is not present at Y1 “ECON”, the UCB has faulted. The UCB should de-energize all compressors on a loss of call for the first stage of cooling, i.e. a loss if 24 volts at the Y1 terminal.
8. If 24 volts are present at the UCB Y1 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freezestat. Check for 24 volts at the HPS1, LPS1, and FS1 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS1 has opened, there will be a 24-volt potential between the LPS1 terminals.
9. If 24 volts is present at the UCB Y1 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for repeat trips. The UCB should be flashing a code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out, remove any call for cooling. This will reset any compressor lock outs, except LPS lockouts. These can only be reset by cycling power to the UCB.

NOTE: While the above step will reset any lock outs, compressor #2 will be held off for the ASCD, and compressor #1 may be held off for a portion of the ASCD. See the next step.

10. If 24 volts is present at the UCB Y1 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.
11. If 24 volts is present at the UCB Y1 terminal and the compressor is not out due to a protective switch trip, repeat trip lock out, or ASCD, the economizer terminals of the UCB may be improperly wired. Check for 24 volts at the Y1 “OUT” terminal of the UCB. If 24 volts is present, trace the wiring from Y1 “OUT” for incorrect wiring. If 24 volts is not present at the Y1 “OUT” terminal, the UCB must be replaced.
12. *For units without economizers:* If 24 volts is present at the Y1 “OUT” terminal, check for 24 volts at the Y1 “ECON” terminal. If 24 volts is not present, check for loose wiring from the Y1 “OUT” terminal to the Mate-N-Lock plug, the jumper in the Mate-N-Lock plug, and in the wiring from the Mate-N-Lock plug to the Y1 “ECON” terminal.

    For units with economizers: If 24 volts is present at the Y1 “OUT” terminal, check for 24 volts at the Y1 “ECON” terminal. If 24 volts is not present, check for loose wiring from the Y1 “OUT” terminal to the Mate-N-Lock plug, a poor connection between the UCB and economizer Mate-N-Lock plugs, loose wiring from the Mate-N-Lock plug to the economizer, back to the Mate-N-Lock plug, and from

the Mate-N-Lock plug to the Y1 “ECON” terminal. The economizer control may have faulted and is not returning the 24 volts to the Y1 “ECON” terminal even though the economizer is not providing free cooling. To test the economizer control, disconnect the Mate-N-Locks and jumper between the WHITE and YELLOW wires of the UCB’s Mate-N-Lock plug.

13. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. They can be checked by local distributors.

    For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.

    For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.

14. If none of the above corrected the error, test the integrity of the UCB. Disconnect the C1 terminal wire and jumper it to the Y1 terminal. DO NOT jump the Y1 to C1 terminals. If the compressor engages, the UCB has faulted.
15. If none of the above correct the error, replace the UCB.

Gas Heat Troubleshooting Guide

On calls for heating, the draft motor operates and the furnace lights but the supply air blower motor does not energize after a short delay (the room thermostat fan switch is in “AUTO” position).

⚠WARNING

The furnace may shut down on a high temperature condition during the procedure. If this occurs, the UCB energize the supply air blower motor until the high temperature limit has reset. Caution should be used at all times as the supply air blower may energize regardless of the room thermostat fan switch position.

1. Place the thermostat fan switch in the “ON” position. If the supply air blower motor energizes, go to Step 9.
2. If the supply air blower motor does not energize when the fan switch is set to “ON,” check that line voltage is being supplied to the contacts of the M3 contactor, and that the contactor is pulled in. Check for loose wiring between the contactor and the supply air blower motor.
3. If M3 is pulled in and voltage is supplied at M3, lightly touch the supply air blower motor housing. If it is hot, the motor may be off on inherent protection. Cancel any thermostat calls and set the fan switch to “AUTO”, wait for the internal overload to reset. Test again when cool.
4. If M3 is not pulled in, check for 24 volts at the M3 coil. If 24 volts is present at M3 but M3 is not pulled in, replace the contactor.
5. Failing the above, if there is line voltage supplied at M3, M3 is pulled in, and the supply air blower motor still does not operate, replace the motor.
6. If 24 volts is not present at M3, check that 24 volts is present at the supply air blower motor terminal on the UCB. If 24 volts is present at the UCB terminal, check for loose wiring between the UCB and M3.
   a. If 24 volts is not present at the UCB supply air blower motor terminal, check for 24 volts from the room thermostat. If 24 volts is not present from the room thermostat, check for the following:
      - Proper operation of the room thermostat (contact between R and G with the fan switch in the “ON” position and in the “AUTO” position during operation calls.)
      - Proper wiring between the room thermostat and the UCB, and
      - Loose wiring from the room thermostat to the UCB
7. If 24 volts is present at the room thermostat but not at the UCB, check for proper wiring between the thermostat and the UCB, i.e. that the thermostat G terminal is connected to the G terminal of the UCB, and for loose wiring.
8. If the thermostat and UCB are properly wired, replace the UCB.
9. If the blower motor runs with the fan switch in the “ON” position but does not run shortly after the furnace has ignited when the fan switch is in the “AUTO” position, check the room thermostat for contact between R and G during “W1” calls.

On calls for heating, the supply air blower operates but the draft motor does not (the room thermostat fan switch is in the “AUTO” position).

1. The draft motor has inherent protection. If the motor shell is hot to the touch, wait for the internal overload to reset.
2. If the motor shell is cold with the room thermostat calling for heat, check for line voltage at the motor's Mate-N-Lok connector attached to the evaporator partition. If line voltage is present, replace the draft motor.
3. If line voltage is not present, check for line voltage at the heat relay (RW1) contacts in the main control box and check to see if the (RW1) is pulled in.
4. If the (RW1) relay is pulled in, check for a loose line voltage connection.
5. If the (RW1) relay is not pulled in, check for 24 volts at the (RW1) coil. If 24 volts is present, replace the (RW1) relay. If 24 volts is not present, check for a loose 24 volt connection back to the relay board and check the connections from the room thermostat to the relay board. If all connections are correct, replace the relay board.

The draft motor runs but the furnace does not light and the sparker does not spark.

1. The ignition control (IC1, IC2) may be locked out due to either a flame roll out or 100% shut off. These safety features are described above. If lock-out has occurred, 24V must be removed from the ignition controls. This is done at the unit or by resetting the room thermostat. After resetting 24V, check

for proper furnace operation. If lock-out continues to occur, locate the source of the problem and correct.

2. Check all 24 volt connections from the relay board to and in the gas heat section. Check low voltage connections to the (ETD) located in the control box.
3. If the furnace is hot, it may be out on an over-temperature condition, wait for limit reset.
4. If the furnace is cold, check for 24 volts at wire 241 attached to the electrical time delay (ETD) located in the main control box. If 24 volts is not found, replace the ETD.
5. 24 volts is found at wire 241, remove the wires attached to the (TDR) and with a VOM, check for continuity across contacts 1 and 2. If none is found, the (TDR) is open and must be replaced. If there is continuity, re-attach the wires.With the draft motor running, check for 24 volts at terminal 4 of (RW1-2) and (RW2-1). If 24 volts is not present, the centrifugal switch (CS) has not closed or has gone bad. Check the line voltage to the unit - if it is correct, replace the draft motor. If line voltage is low, call the power company.
6. Check for 24V at terminal 2 of (RW1-2 and RW2-1). If 24V is not present, check for 24V at (RW1 and RW2) relay coils. If these relays are pulled in, then check for a loose connection at terminal 2 and terminal 4 of each relay. If no problem is found, then replace (RW1 and/or RW2) as required.
7. If 24 volts is present at the ignitor controls, check all control wiring at the ignitor controls and the high tension wire to the ignitors. Check that the ground wires from the ignitor controls, the gas valves and pilot burners are all intact and making good electrical connection. Check to make sure that the ceramic insulator on the pilot ignitors or sensors is not broken or cracked, if all are intact, replace the ignition control IC1 or IC2.

The draft motor runs and the ignitor sparks at the pilot burner but the pilot does not ignite and a gas odor is not detected at the draft motor outlet.

1. Check to make sure gas is being supplied to the unit. Make sure that the gas pressure to the unit is within the proper limits as described in the “POST START CHECK LIST” page 47 and that the pilot adjust screw is allowing some flow of gas as described in “PILOT CHECKOUT” page 48.
2. Check all wiring between the ignitor control and the gas valve. Check to make sure the ground connections are intact.
3. If the wiring is intact, check for 24 volts across terminals “PV” and “COMMON” on the ignitor control. If 24 volts is not present, replace the ignitor control.
4. If 24 volts is present, remove the pilot burner and remove the pilot orifice from the pilot burner. The orifice is removed in the direction opposite the flow of gas. Inspect the orifice for obstruction. If it is clear, replace the main gas valve.

The ignitor sparks at the pilot burner but the pilot does not ignite and a gas odor is detected at the draft motor outlet.

1. Adjust the pilot adjust screw on the gas valve as described in “PILOT CHECKOUT” page 48.
2. Check the supply pressure as described in “POST START CHECK LIST” page 47. Make adjustments as necessary.
3. Check the pilot orifice for obstruction as described in paragraph above. Clean as needed but the problem should not be the gas valve.

The pilot burner ignites but the ignitor continues to spark and the main burners do not ignite.

1. Make the same checks and adjustment as described in “PILOT CHECKOUT” page 48.
2. Check the supply pressure as described in “POST START CHECK LIST” page 47. Make adjustments as necessary.
3. Make sure that the pilot burner is not bent or damaged.
4. Make sure that the ground connections at the pilot burner, gas valve and ignitor control are intact. Check the high tension wire for good electrical connection. If all are intact, replace the ignitor module.

The pilot burner lights and the spark stops but the main burners do not light.

1. Check electrical connections between the ignitor control and the gas valve. If intact, check for 24 volts across terminals “MV” and “COMMON” terminals. If no voltage detected, replace ignitor control. If voltage is present, replace gas valve.

Furnace lights with roll-out or one burner has delayed ignition.

1. Make sure that the pilot burner is aligned properly with the carryover as described in “PILOT CHECKOUT” page 48.
2. Make sure that the carryovers on adjoining burners are screwed fast and are level with respect to one another.

Main burners light but exhibit erratic flame characteristics.

1. Adjust air shutters as described in “BURNER AIR SHUTTER ADJUSTMENT” page 48.
2. Check the main burner orifices for obstruction and alignment. Removal procedure is described in BURNER INSTRUCTIONS page 48. Clean or replace burner orifices and burners as needed.

Unit Board Flash Codes

Various flash codes are utilized by the unit control board (UCB) to aid in troubleshooting. Flash codes are distinguished by the short on and off cycle used (approximately 200ms on and 200ms off). To show normal operation, the control board flashes a 1 second on, 1 second off “heartbeat” during normal operation. This is to verify that the UCB is functioning correctly. Do not confuse this with an error flash code. To prevent confusion, a 1-flash, flash code is not used.

Alarm condition codes are flashed on the UCB lower left Red LED, See Figure 30. While the alarm code is being flashed, it will also be shown by the other LEDs: lit continuously while the alarm is being flashed. The total of the continuously lit LEDs equates to the number of flashes, and is shown in the table. Pressing and releasing the LAST ERROR button on the UCB can check the alarm history. The UCB will cycle through the last five (5) alarms, most recent to oldest, separating each alarm flash code by approximately 2 seconds. Flash code 21 is a non-

alarm condition but due to the space constraints of the UCB, will be indicated by the Red LED. In all other cases, a flashing Green LED will be used to indicate non-alarm conditions.

In some cases, it may be necessary to “zero” the ASCD for the compressors in order to perform troubleshooting. To reset all ASCDs for one cycle, press and release the UCB TEST/ RESET button once.

Flash codes that do and do not represent alarms are listed in Table 24.

Table 24: Unit Control Board Flash Codes

Flash Codes	Description	Green LED 16	Red LED 8	Red LED 4	Red Led 2	Red LED 1
On Steady	This is a Control Failure	-	-	-	-	-
1 Flash	Not Applicable	-	-	-	-	-
2 Flashes	Control waiting ASCD[1]	Flashing	Off	Off	On	Off
3 Flashes	HPS1 Compressor Lockout	Off	Off	Off	On	On
4 Flashes	HPS2 Compressor Lockout	Off	Off	On	Off	Off
5 Flashes	LPS1 Compressor Lockout	Off	Off	On	Off	On
6 Flashes	LPS2 Compressor Lockout	Off	Off	On	On	Off
7 Flashes	FS1 Compressor Lockout	Off	Off	On	On	On
8 Flashes	FS2 Compressor Lockout	Off	On	Off	Off	Off
9 Flashes	Ignition Control Locked Out / Ignition Control Failure	Off	On	Off	Off	On
10 Flashes	Compressors Locked Out on Low Outdoor Air Temperature[1]	Flashing	On	Off	On	Off
11 Flashes	Compressors locked out because the Economizer is using free Cooling[1]	Flashing	On	Off	On	On
12 Flashes	Unit Locked Out due to Fan Overload Switch Failure	Off	On	On	Off	Off
13 Flashes	Compressor Held Off due to Low Voltage[1]	Flashing	On	On	Off	On
14 Flashes	EEPROM Storage Failure	Off	On	On	On	Off
15 Flashes	HPS3 Compressor Lockout	Off	On	On	On	On
16 Flashes	HPS4 Compressor Lockout	On	Off	Off	Off	Off
17 Flashes	LPS3 Compressor Lockout	On	Off	Off	Off	On
18 Flashes	LPS4 Compressor Lockout	On	Off	Off	On	Off
19 Flashes	FS3 Compressor Lockout	On	Off	Off	On	On
20 Flashes	FS4 Compressor Lockout	On	Off	On	Off	Off
21 Flashes	Compressor Off due to Low SAT[1]	On	Off	On	Off	On
OFF	No Power or Control Failure	Off	Off	Off	Off	Off

1. Non-alarm conditions.

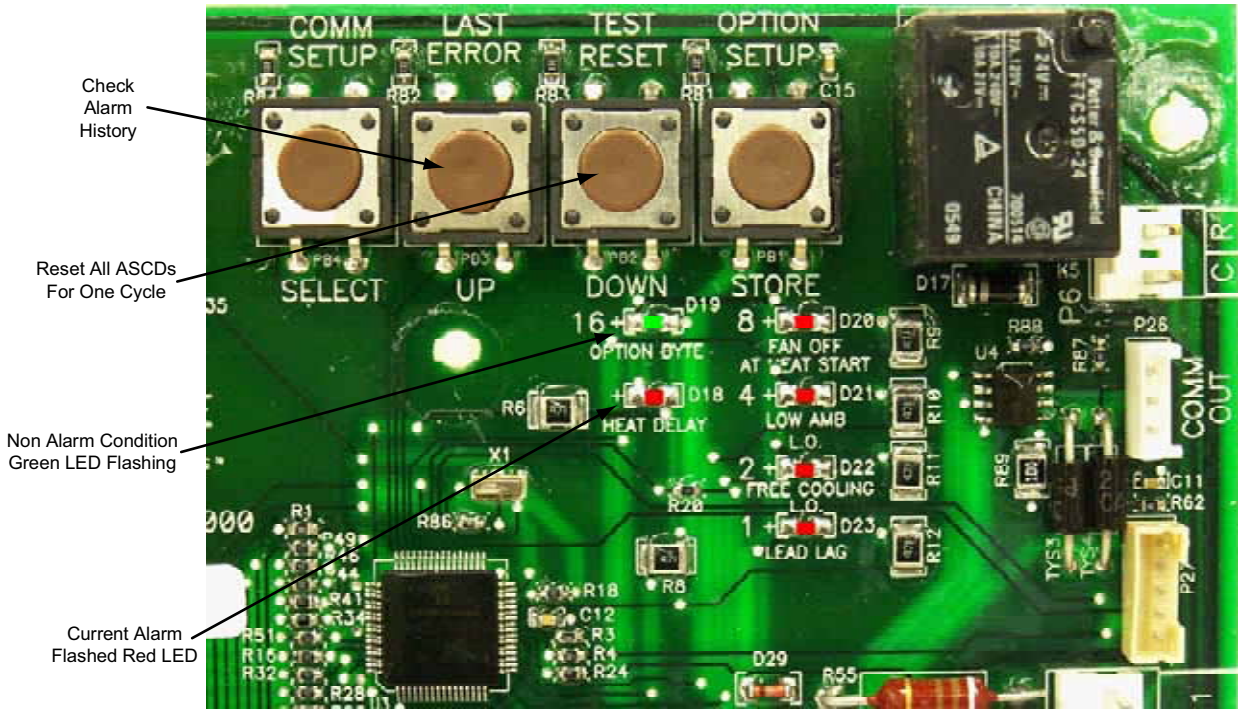


Figure 30: Unit Control Board

173463-YIM-C-0806
Supersedes: 173463-YIM-B-0706

Unitary Products Group

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Norman OK 73069